ThinkStation E32
Hardware Maintenance Manual

Machine Types: 30A0, 30A1, 30A2, and 30A3

Note: Before using this information and the product it supports, be sure to read and understand Chapter 2 “Safety information” on page 3 and Appendix B “Notices” on page 225.

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Chapter 1. About this manual

This manual provides service and reference information for ThinkStation® computers listed on the front cover. This manual is intended only for trained service personnel who are familiar with Lenovo® computer products.

Before servicing a Lenovo computer product, be sure to read "Important safety information" on page 1.

Chapter 8 "Symptom-to-FRU Index" on page 63 and Chapter 12 "Additional service information" on page 219 are not specific to any machine type and are applicable to all ThinkStation computers.

For major Field Replaceable Units (FRU) locations and Customer Replaceable Unit (CRU) identification, see Chapter 9 "Locations" on page 69.

For FRU replacement instructions, see Chapter 10 "Replacing FRUs (machine types: 30A0 and 30A1)" on page 85.

For FRU part numbers, go to http:/www.lenovo.com/serviceparts-lookup.

Important safety information

Be sure to read all caution and danger statements in this book before performing any of the instructions.

Veuillez lire toutes les consignes de type DANGER et ATTENTION du présent document avant d'exécuter les instructions.

Lesen Sie unbedingt alle Hinweise vom Typ "ACHTUNG" oder "VORSICHT" in dieser Dokumentation, bevor Sie irgendwelche Vorgänge durchführen

Leggere le istruzioni introdotte da ATTENZIONE e PERICOLO presenti nel manuale prima di eseguire una qualsiasi delle istruzioni

Certifique-se de ler todas as instruções de cuidado e perigo neste manual antes de executar qualquer uma das instruções

Es importante que lea todas las declaraciones de precaución y de peligro de este manual antes de seguir las instrucciones.

تأكد من قراءة كل التحذيرات الموجودة في هذا الكتاب قبل اتباع هذه التعليمات .

执行任何说明之前，请确保已阅读本书中的所有警告和危险声明。

執行任何指示前，請確實閱讀本書中的所有警告及危險聲明。

ודאו שקראתם את כל הודעות האזהרה והסכנה במסמך זה לפני שתבצעו פעולה כלשהי.

본 사용 설명서에 기재된 내용을 실행하기 전에 모든 주의사항 및 위험사항을 숙지하십시오.

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Chapter 2. Safety information

This chapter contains the safety information that you need to be familiar with before servicing a computer.

General safety

Follow these rules to ensure general safety:

- Observe good housekeeping in the area of the machines during and after maintenance.
- When lifting any heavy object:
    1. Ensure you can stand safely without slipping.
    2. Distribute the weight of the object equally between your feet.
    3. Use a slow lifting force. Never move suddenly or twist when you attempt to lift.
    4. Lift by standing or by pushing up with your leg muscles; this action removes the strain from the muscles in your back.

    Attention: Do not attempt to lift any objects that weigh more than 16 kg (35 lb) or objects that you think are too heavy for you.
- Do not perform any action that causes hazards to the customer, or that makes the equipment unsafe.
- Before you start the machine, ensure that other service representatives and the customer's personnel are not in a hazardous position.
- Place removed covers and other parts in a safe place, away from all personnel, while you are servicing the machine.
- Keep your tool case away from walk areas so that other people will not trip over it.
- Do not wear loose clothing that can be trapped in the moving parts of a machine. Ensure that your sleeves are fastened or rolled up above your elbows. If your hair is long, fasten it.
- Insert the ends of your necktie or scarf inside clothing or fasten it with a nonconductive clip, approximately 8 centimeters (3 inches) from the end.
- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing.
  Remember: Metal objects are good electrical conductors.
- Wear safety glasses when you are: hammering, drilling, soldering, cutting wire, attaching springs, using solvents, or working in any other conditions that might be hazardous to your eyes.
- After service, reinstall all safety shields, guards, labels, and ground wires. Replace any safety device that is worn or defective.
- Reinstall all covers correctly before returning the machine to the customer.

Electrical safety

⚠

CAUTION:
Electrical current from power, telephone, and communication cables can be hazardous. To avoid personal injury or equipment damage, disconnect the attached power cords, telecommunication systems, networks, and modems before you open the computer covers, unless instructed otherwise in the installation and configuration procedures.

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Observe the following rules when working on electrical equipment.

Important: Use only approved tools and test equipment. Some hand tools have handles covered with a soft material that does not insulate you when working with live electrical currents. Many customers have, near their equipment, rubber floor mats that contain small conductive fibers to decrease electrostatic discharges. Do not use this type of mat to protect yourself from electrical shock.

- Find the room emergency power-off (EPO) switch, disconnecting switch, or electrical outlet. If an electrical accident occurs, you can then operate the switch or unplug the power cord quickly.
- Do not work alone under hazardous conditions or near equipment that has hazardous voltages.
- Disconnect all power before:
  - Performing a mechanical inspection
  - Working near power supplies
  - Removing or installing Field Replaceable Units (FRUs)
- Before you start to work on the machine, unplug the power cord. If you cannot unplug it, ask the customer to power-off the wall box that supplies power to the machine and to lock the wall box in the off position.
- If you need to work on a machine that has exposed electrical circuits, observe the following precautions:
  - Ensure that another person, familiar with the power-off controls, is near you.
    Remember: Another person must be there to switch off the power, if necessary.
  - Use only one hand when working with powered-on electrical equipment; keep the other hand in your pocket or behind your back.
    Remember: There must be a complete circuit to cause electrical shock. By observing the above rule, you may prevent a current from passing through your body.
  - When using a tester, set the controls correctly and use the approved probe leads and accessories for that tester.
  - Stand on suitable rubber mats (obtained locally, if necessary) to insulate you from grounds such as metal floor strips and machine frames.

  Observe the special safety precautions when you work with very high voltages; these instructions are in the safety sections of maintenance information. Use extreme care when measuring high voltages.
- Regularly inspect and maintain your electrical hand tools for safe operational condition.
- Do not use worn or broken tools and testers.
- *Never assume* that power has been disconnected from a circuit. First, *check* that it has been powered-off.
- Always look carefully for possible hazards in your work area. Examples of these hazards are moist floors, nongrounded power extension cables, power surges, and missing safety grounds.
- Do not touch live electrical circuits with the reflective surface of a plastic dental mirror. The surface is conductive; such touching can cause personal injury and machine damage.
- Do not service the following parts with the power on when they are removed from their normal operating places in a machine:
  - Power supply units
  - Pumps
  - Blowers and fans
  - Motor generators

  and similar units. (This practice ensures correct grounding of the units.)
- If an electrical accident occurs:
  - Use caution; do not become a victim yourself.
  - Switch off power.

– Send another person to get medical aid.

Safety inspection guide

The intent of this inspection guide is to assist you in identifying potentially unsafe conditions on these products. Each machine, as it was designed and built, had required safety items installed to protect users and service personnel from injury. This guide addresses only those items. However, good judgment should be used to identify potential safety hazards due to attachment of features or options not covered by this inspection guide.

If any unsafe conditions are present, you must determine how serious the apparent hazard could be and whether you can continue without first correcting the problem.

Consider these conditions and the safety hazards they present:

- Electrical hazards, especially primary power (primary voltage on the frame can cause serious or fatal electrical shock).
- Explosive hazards, such as a damaged CRT face or bulging capacitor
- Mechanical hazards, such as loose or missing hardware

The guide consists of a series of steps presented in a checklist. Begin the checks with the power off, and the power cord disconnected.

Checklist:

1. Check exterior covers for damage (loose, broken, or sharp edges).
2. Power-off the computer. Disconnect the power cord.
3. Check the power cord for:
   a. A third-wire ground connector in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and frame ground.
   b. The power cord should be the appropriate type as specified in the parts listings.
   c. Insulation must not be frayed or worn.
4. Remove the cover.
5. Check for any obvious alterations. Use good judgment as to the safety of any alterations.
6. Check inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
7. Check for worn, frayed, or pinched cables.
8. Check that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

Handling electrostatic discharge-sensitive devices

Any computer part containing transistors or integrated circuits (ICs) should be considered sensitive to electrostatic discharge (ESD). ESD damage can occur when there is a difference in charge between objects. Protect against ESD damage by equalizing the charge so that the machine, the part, the work mat, and the person handling the part are all at the same charge.

Notes:

1. Use product-specific ESD procedures when they exceed the requirements noted here.
2. Make sure that the ESD protective devices you use have been certified (ISO 9000) as fully effective.

When handling ESD-sensitive parts:

- Keep the parts in protective packages until they are inserted into the product.

- Avoid contact with other people while handling the part.
- Wear a grounded wrist strap against your skin to eliminate static on your body.
- Prevent the part from touching your clothing. Most clothing is insulative and retains a charge even when you are wearing a wrist strap.
- Use the black side of a grounded work mat to provide a static-free work surface. The mat is especially useful when handling ESD-sensitive devices.
- Select a grounding system, such as those listed below, to provide protection that meets the specific service requirement.

  Note: The use of a grounding system is desirable but not required to protect against ESD damage.

  - Attach the ESD ground clip to any frame ground, ground braid, or green-wire ground.
  - Use an ESD common ground or reference point when working on a double-insulated or battery-operated system. You can use coax or connector-outside shells on these systems.
  - Use the round ground-prong of the ac plug on ac-operated computers.

Grounding requirements

Electrical grounding of the computer is required for operator safety and correct system function. Proper grounding of the electrical outlet can be verified by a certified electrician.

Safety notices (multi-lingual translations)

The caution and danger safety notices in this section are provided in the following languages:

- English
- Arabic
- Brazilian/Portuguese
- Chinese (simplified)
- Chinese (traditional)
- French
- German
- Hebrew
- Italian
- Korean
- Spanish

DANGER

Electrical current from power, telephone and communication cables is hazardous.

To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**

- **Connect all power cords to a properly wired and grounded electrical outlet.**
- **Connect to properly wired outlets any equipment that will be attached to this product.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described in the following tables when installing, moving, or opening covers on this product or attached devices.**

To Connect	To Disconnect
1. Turn everything OFF.	1. Turn everything OFF.
2. First, attach all cables to devices.	2. First, remove power cords from outlet.
3. Attach signal cables to connectors.	3. Remove signal cables from connectors.
4. Attach power cords to outlet.	4. Remove all cables from devices.
5. Turn device ON.	

CAUTION:
When replacing the lithium battery, use only Part Number 45C1566 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of. *Do not:*

- **Throw or immerse into water**
- **Heat to more than 100°C (212°F)**
- **Repair or disassemble**

Dispose of the battery as required by local ordinances or regulations.

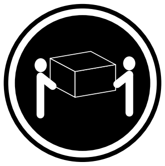
CAUTION:
When laser products (such as CD-ROMs, DVD-ROM drives, fiber optic devices, or transmitters) are installed, note the following:

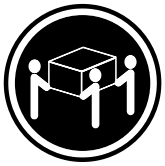
- **Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.**
- **Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.**

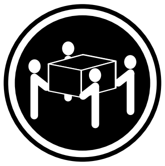
DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following:

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

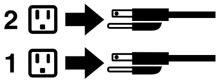

≥18 kg (37 lbs)


≥32 kg (70.5 lbs)


≥55 kg (121.2 lbs)

CAUTION:
Use safe practices when lifting.

CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



خطر

التيار الكهربي الموجود بمصدر الطاقة أو أجهزة التليفون أو أسلاك الإتصالات يشكل خطورة.

لتفادي مخاطر الصدمات الكهربائية:

لا تحاول توصيل أو فصل أي أسلاك أو القيام بعمليات تركيب أو صيانة أوإعادة توصيف لهذا المنتج أثناء وجود عاصفة كهربائية.

يجب توصيل كل أسلاك الكهرباء في مخارج كهرباء ذات توصيلات أسلاك وتوصيلات أرضية صحيحة
يجب توصيل أي جهاز سيتم الحاقه بهذا المنتج في مخارج كهرباء ذات توصيلات أسلاك صحيحة.

وإن أمكن يجب استخدام يد واحدة فقط في توصيل أو فصل أسلاك الإشارة.

لا تحاول تشغيل أي جهاز إذا كان هناك أثر لحرق أو مياه أو تلف بالمكونات
يجب فصل أسلاك الكهرباء وأنظمة الاتصالات وشبكات الاتصال وأجهزة المودم الملحقة قبل فتح أغطية الجهاز، مالم يتم طلب خلاف ذلك في التعليمات الخاصة بالتركيب والتوصيف.
قم بتوصيل وفصل الأسلاك كما هو موضح في الجدول التالي وذلك عند القيام بعمليات التركيب أو النقل أو فتح أغطية هذا المنتج أو الأجهزة الملحقة.

للتوصيل:	للفصل:
قم بإيقاف كل شيء.	قم بإيقاف كل شيء.
أولا، قم بتوصيل كل الأسلاك بالأجهزة.	أولا، قم بفصل كل أسلاك الكهرباء من المخرج.
قم بتوصيل أسلاك الإشارة في لموصلات.	قم بفصل أسلاك الإشارة من الموصلات.
قم بتوصيل أسلاك الكهرباء في المخارج.	قم بفصل كل الأسلاك من الأجهزة.
قم بتشغيل الجهاز.	

تنبيه :

عند استبدال البطارية الليثيوم، استخدم فقط رقم الجزء الخاص Part Number 45C1566
أو نوع أخر يكون على نفس مستوى الكفاءة يحدده لك المصنع.
اذا كان النظام الخاص يستخدم معه بطارية ليثيوم قم باستبدالها بنفس النوع الذي تم
صناعته من خلال نفس المصنع. تحتوي البطارية على مادة الليثيوم ويمكن أن تنفجرفي حالة عدم استخدامها
أو التعامل معها بطريقة صحيحة أو عند التخلص منها بطريقة خطأ.

لا تقم بـ:

- **القاء البطارية أو غمرها في الماء**
- **تسخينها أعلى من ١٠٠ درجة مئوية°و(٢١٢ ° فهرنهيت)**
- **بتصليحها أو فكها**

تخلص من البطارية طبقا للقانون أو النظام المحلي .

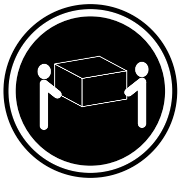
تنبيــه :
أثناء تركيب منتجات ليزر (مثل CD-ROMs أو وحدة تشغيل DVD أو أجهزة Fiber Optic أو
وحدات الارسال) يجب مراعاة الآتي:

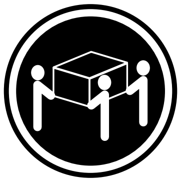
لا تنزع الأغطية. قد ينتج عن نزع أغطية منتج الليزر انفجار أشعة الليزر شديدة الخطورة.
لا يوجد أجزاء يمكن تغييرها داخل الجهاز. قد ينتج عن استخدام تحكمات أو تعديلات أو عمل أي تصرفات أخرى تخالف ما هو محددا هنا الى
انفجار أشعة شديدة الخطورة.

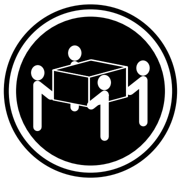
خطــر

تحتوى بعض منتجات الليزر على الفئة دايود ليزر مدمج من الفئة Class 3A أو Class 3B. يجب مراعاة الآتي .

أشعة الليزر عند الفتح. لا تحدق الى الاشعاع و لا تنظر اليه مباشرة بواسطة أي أجهزة مرئية وتجنب التعرض المباشر للاشعاع .

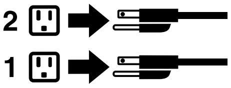

≥18 kg (37 lbs)


≥32 kg (70.5 lbs)


≥55 kg (121.2 lbs)

تنبيه :
يجب استخدام ممارسات آمنة عند الرفع

تنبيــه :
لا يقم زر التحكم في التشغيل الموجود على الجهاز والمفتاح الكهربائي الموجود على
لوحة التحكم بايقاف التيار الكهربائي المار بالجهاز. قد يكون للجهاز أكثر من سلك كهربائي واحد.
لايقاف التيار الكهربائي المار بالجهاز، تأكد من فصل جميع أسلاك الكهرباء من مصدر الكهرباء .



PERIGO

A corrente elétrica proveniente de cabos de alimentação, de telefone e de comunicações é perigosa.

Para evitar risco de choque elétrico:

- Não conecte nem desconecte nenhum cabo ou execute instalação, manutenção ou reconfiguração deste produto durante uma tempestade com raios.
- Conecte todos os cabos de alimentação a tomadas elétricas corretamente instaladas e aterradas.
- Todo equipamento que for conectado a este produto deve ser conectado a tomadas corretamente instaladas.
- Quando possível, utilize apenas uma das mãos para conectar ou desconectar cabos de sinal.
- Nunca ligue nenhum equipamento quando houver evidência de fogo, água ou danos estruturais.
- Antes de abrir tampas de dispositivos, desconecte cabos de alimentação, sistemas de telecomunicação, redes e modems conectados, a menos que especificado de maneira diferente nos procedimentos de instalação e configuração.
- Conecte e desconecte os cabos conforme descrito na tabela apresentada a seguir ao instalar, mover ou abrir tampas deste produto ou de dispositivos conectados.

Para Conectar:	**Para Desconectar:**
1. DESLIGUE Tudo. 2. Primeiramente, conecte todos os cabos aos dispositivos. 3. Conecte os cabos de sinal aos conectores. 4. Conecte os cabos de alimentação às tomadas. 5. LIGUE os dispositivos.	1. DESLIGUE Tudo. 2. Primeiramente, remova os cabos de alimentação das tomadas. 3. Remova os cabos de sinal dos conectores. 4. Remova todos os cabos dos dispositivos.

CUIDADO:

Ao substituir a bateria de lítio, utilize apenas uma bateria com Número de Peça 45C1566 ou um tipo de bateria equivalente recomendado pelo Se o seu sistema possui um módulo com uma bateria de lítio, substitua-o apenas por um módulo do mesmo tipo e do mesmo fabricante. A bateria contém lítio e pode explodir se não for utilizada, manuseada ou descartada de maneira correta.

Não:

- Jogue ou coloque na água
- Aqueça a mais de 100°C (212°F)
- Conserte nem desmonte

Descarte a bateria conforme requerido pelas leis ou regulamentos locais.

PRECAUCIÓN:

Quando produtos a laser (como unidades de CD-ROMs, unidades de DVD-ROM, dispositivos de fibra ótica ou transmissores) estiverem instalados, observe o seguinte:

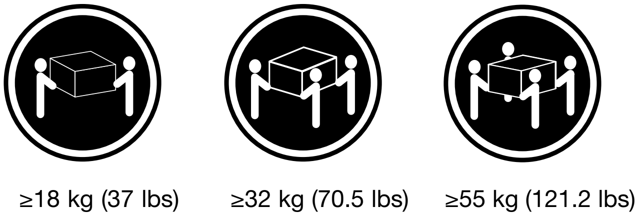
- Não remova as tampas. A remoção das tampas de um produto a laser pode resultar em exposição prejudicial à radiação de laser. Não existem peças que podem ser consertadas no interior do dispositivo.

- A utilização de controles ou ajustes ou a execução de procedimentos diferentes dos especificados aqui pode resultar em exposição prejudicial à radiação.

PERIGO

Alguns produtos a laser contêm diodo de laser integrado da Classe 3A ou da Classe 3B. Observe o seguinte:

Radiação a laser quando aberto. Não olhe diretamente para o feixe a olho nu ou com instrumentos ópticos e evite exposição direta ao feixe.



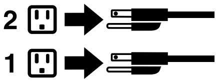
≥18 kg (37 lbs) ≥32 kg (70.5 lbs) ≥55 kg (121.2 lbs)

CUIDADO:

Utilize procedimentos de segurança para levantar equipamentos.

CUIDADO:

O botão de controle de alimentação do dispositivo e o botão para ligar/desligar da fonte de alimentação não desligam a corrente elétrica fornecida ao dispositivo. O dispositivo também pode ter mais de um cabo de alimentação. Para remover toda a corrente elétrica do dispositivo, assegure que todos os cabos de alimentação estejam desconectados da fonte de alimentação.



危险

电源、电话和通信电缆中的电流是危险的。

为避免电击危险：

- 请勿在雷电期间连接或断开任何电缆的连接，或者对本产品进行安装、维护或重新配置。
- 将所有电源线连接到正确连线和妥善接地的电源插座。
- 将所有要连接到该产品的设备连接到正确连线的插座。
- 如果可能，请仅使用一只手来连接或断开信号电缆的连接。
- 切勿在有火、水、结构损坏迹象的情况下开启任何设备。
- 在打开设备外盖之前请断开已连接的电源线、远程通信系统、网络和调制解调器，除非在安装和配置过程中另有说明。
- 当安装、移动或打开该产品或连接设备的外盖时，请按照下表所述来连接或断开电缆的连接。

要连接	要断开连接
1. 切断所有电源。 2. 首先将所有电缆连接到设备。 3. 将信号电缆连接到接口。 4. 将电源线连接到插座。 5. 开启设备。	1. 切断所有电源。 2. 首先从插座上拔出电源线。 3. 从接口上拔出信号电缆。 4. 从设备上拔出所有电缆。

警告：
更换锂电池时，请仅使用部件号为 45C1566 的电池或制造商推荐的同类电池。如果您的系统有包含锂电池的模块，请仅使用同一制造商生产的相同模块类型来替换该模块。该电池中含有锂，如果使用、操作或处理不当，可能会发生爆炸。

切勿：

- 投入或浸入水中
- 加热到 100℃（212℉）以上
- 维修或拆卸

请按照当地法令或条例的要求处理电池。

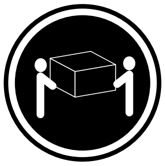
警告：
安装激光产品（例如 CD-ROM、DVD-ROM 驱动器、光纤设备或发射设备）时，请注意以下声明：

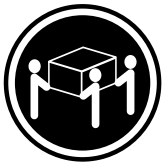
- 请勿卸下外盖。卸下激光产品的外盖可能导致遭受激光辐射的危险。该设备内没有可维修的部件。
- 如果不按照此处指定的过程进行控制、调整或操作，则有可能导致遭受辐射的危险。

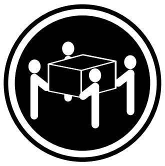
危险

某些激光产品包含嵌入式 3A 类或 3B 类激光二极管。请注意以下声明：

打开后有激光辐射。请勿注视光束，请勿直接用光学仪器查看，并请避免直接暴露在光束中。

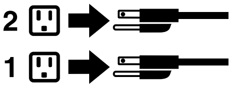

≥18 千克（37 磅）


≥32 千克（70.5 磅）


≥55 千克（121.2 磅）

警告：
抬起时请采取安全措施。

警告：
设备上的电源控制按钮和电源上的电源开关不会切断供给该设备的电流。该设备还可能有多条电源线。要切断该设备的所有电流，请确保所有电源线都与电源断开连接。



危險

電源、電話及通訊纜線上的電流都具有危險性。
若要避免觸電危險：
- 請勿在雷雨期間，連接或拔除纜線、執行安裝、維護或重新配置本產品。
- 將所有電源線連接到正確配線及接地的電源插座。
- 任何與本產品連接的設備都必須連接到配線妥當的電源插座。
- 請盡可能用單手連接或拔除信號線。
- 發生火災、水災或結構損害時，絕對不要開啟任何設備。
- 除非在安裝及配置程序中另有指示，否則在開啟裝置機蓋之前，請拔掉連接的電源線、電信系統、網路及數據機。
- 安裝、移動或開啟本產品或附屬裝置的機蓋時，請遵循下列說明連接及拔掉纜線。

連線	切斷連線
1. 關閉所有開關。	1. 關閉所有開關。
2. 首先，連接所有接線到裝置。	2. 首先，拔掉插座上的電源線。
3. 連接信號線到接頭。	3. 拔掉接頭上的信號線。
4. 連接電源線到插座。	4. 拔掉裝置上所有接線。
5. 開啟裝置。	

警告：
更換鋰電池時，請僅使用產品編號 **45C1566** 或製造商所建議的同類型電池。
如果您的系統中含有鋰電池模組，請僅使用同一家製造商所生產的相同模組進行更換。
如果未以正確方式使用、處理或棄置含鋰的電池，會有爆炸的危險。
請勿：

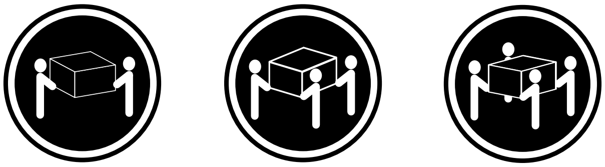
- 沾溼或浸入水中
- 置於 **100°C (212°F)** 以上的高溫環境
- 修理或拆開

請按照各地區有關廢棄電池的法令和規定處理舊電池。

警告：
- 請勿移除機蓋。移除雷射產品的機蓋，可能會導致暴露在危險的雷射輻射中。裝置內部並無可自行維修的零件。
- 利用或執行非本文中所指定的控制、調整及執行程序，可能會導致危險的輻射外洩。

危險

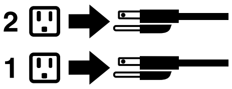
部分雷射產品含有內嵌式 **Class 3A** 或 **Class 3B** 雷射二極體。請注意下列事項：
在開啟光碟機時，會發生雷射輻射。請勿直視光束或用光學儀器直接檢視，並避免直接暴露在光束中。



≥ 18 公斤（37 磅） ≥ 32 公斤（70.5 磅） ≥ 55 公斤（121.2 磅）

警告：
搬運時請注意安全。

警告：
裝置上的電源控制按鈕及電源供應器上的電源開關，無法關閉裝置所產生的電流。
該裝置可能有多條電源線。若要除去裝置流出的所有電流，請確認已切斷所有電源線的電源。



DANGER

Le courant électrique provenant de l'alimentation, du téléphone et des câbles de transmission peut présenter un danger.

Pour éviter tout risque de choc électrique :

- Ne manipulez aucun câble et n'effectuez aucune opération d'installation, d'entretien ou de reconfiguration de ce produit au cours d'un orage.
- Branchez tous les cordons d'alimentation sur un socle de prise de courant correctement câblé et mis à la terre.
- Branchez sur des socles de prise de courant correctement câblés tout équipement connecté à ce produit.
- Lorsque cela est possible, n'utilisez qu'une seule main pour connecter ou déconnecter les câbles d'interface.
- Ne mettez jamais un équipement sous tension en cas d'incendie ou d'inondation, ou en présence de dommages matériels.
- Avant de retirer les carters de l'unité, mettez celle-ci hors tension et déconnectez ses cordons d'alimentation, ainsi que les câbles qui la relient aux réseaux, aux systèmes de télécommunication et aux modems (sauf instruction contraire mentionnée dans les procédures d'installation et de configuration).
- Lorsque vous installez, que vous déplacez, ou que vous manipulez le présent produit ou des périphériques qui lui sont raccordés, reportez-vous aux instructions ci-dessous pour connecter et déconnecter les différents cordons.

Connexion	Déconnexion
1. Mettez les unités HORS TENSION. 2. Commencez par brancher tous les cordons sur les unités. 3. Branchez les câbles d'interface sur des connecteurs. 4. Branchez les cordons d'alimentation sur des prises. 5. Mettez les unités SOUS TENSION.	1. Mettez les unités HORS TENSION. 2. Débranchez les cordons d'alimentation des prises. 3. Débranchez les câbles d'interface des connecteurs. 4. Débranchez tous les câbles des unités.

ATTENTION:

Remplacer la pile au lithium usagée par une pile de référence identique exclusivement, (référence 45C1566), ou suivre les instructions du fabricant qui en définit les équivalences. Si votre système est doté d'un module contenant une pile au lithium, vous devez le remplacer uniquement par un module identique, produit par le même fabricant. La pile contient du lithium et peut exploser en cas de mauvaise utilisation, de mauvaise manipulation ou de mise au rebut inappropriée.

Ne pas :

- **la jeter à l'eau,**
- **l'exposer à des températures supérieures à 100°C,**
- **chercher à la réparer ou à la démonter.**

Ne pas mettre la pile à la poubelle. Pour la mise au rebut, se reporter à la réglementation en vigueur.

ATTENTION:

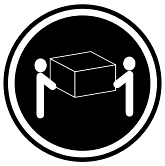
Si des produits à laser (tels que des unités de CD-ROM, de DVD-ROM, des unités à fibres optiques, ou des émetteurs) sont installés, prenez connaissance des informations suivantes :

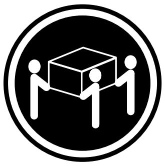
- **Ne retirez pas le carter. En ouvrant l'unité de CD-ROM ou de DVD-ROM, vous vous exposez au rayonnement dangereux du laser. Aucune pièce de l'unité n'est réparable.**
- **Pour éviter tout risque d'exposition au rayon laser, respectez les consignes de réglage et d'utilisation des commandes, ainsi que les procédures décrites dans le présent manuel.**

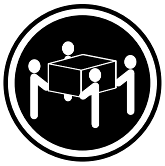
DANGER

Certains produits à laser contiennent une diode à laser intégrée de classe 3A ou 3B. Prenez connaissance des informations suivantes:

Rayonnement laser lorsque le carter est ouvert. Evitez toute expositiondirecte au rayon laser. Evitez de regarder fixement le faisceau ou del'observer à l'aide d'instruments optiques.


≥18 kg (37 lbs)


≥32 kg (70.5 lbs)

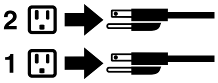

≥55 kg (121.2 lbs)

ATTENTION:

Soulevez la machine avec précaution.

ATTENTION:

L'interrupteur de contrôle d'alimentation de l'unité et l'interrupteur dubloc d'alimentation ne coupent pas le courant électrique alimentantl'unité. En outre, le système peut être équipé de plusieurs cordonsd'alimentation. Pour mettre l'unité hors tension, vous devez déconnectertous les cordons de la source d'alimentation.



VORSICHT

An Netz-, Telefon- und Datenleitungen können gefährliche Spannungen anliegen.

Aus Sicherheitsgründen:

- **Bei Gewitter an diesem Gerät keine Kabel anschließen oder lösen. Ferner keine Installations-, Wartungs- oder Rekonfigurationsarbeiten durchführen.**
- **Gerät nur an eine Schutzkontaktsteckdose mit ordnungsgemäß geerdetem Schutzkontakt anschließen.**
- **Alle angeschlossenen Geräte ebenfalls an Schutzkontaktsteckdosen mit ordnungsgemäß geerdetem Schutzkontakt anschließen.**
- **Die Signalkabel nach Möglichkeit einhändig anschließen oder lösen, um einen Stromschlag durch Berühren von Oberflächen mit unterschiedlichem elektrischem Potenzial zu vermeiden.**
- **Geräte niemals einschalten, wenn Hinweise auf Feuer, Wasser oder Gebäudeschäden vorliegen.**
- **Die Verbindung zu den angeschlossenen Netzkabeln, Telekommunikationssystemen, Netzwerken und Modems ist vor dem Öffnen des Gehäuses zu unterbrechen, sofern in den Installations- und Konfigurationsprozeduren keine anders lautenden Anweisungen enthalten sind.**
- **Zum Installieren, Transportieren und Öffnen der Abdeckungen des Computers oder der angeschlossenen Einheiten die Kabel gemäß der folgenden Tabelle anschließen und abziehen.**

Zum Anschließen der Kabel gehen Sie wie folgt vor	Zum Abziehen der Kabel gehen Sie wie folgt vor
1. Schalten Sie alle Einheiten AUS. 2. Schließen Sie erst alle Kabel an die Einheiten an. 3. Schließen Sie die Signalkabel an die Buchsen an. 4. Schließen Sie die Netzkabel an die Steckdose an. 5. Schalten Sie die Einheit EIN.	1. Schalten Sie alle Einheiten AUS. 2. Ziehen Sie zuerst alle Netzkabel aus den Netzsteckdosen. 3. Ziehen Sie die Signalkabel aus den Buchsen. 4. Ziehen Sie alle Kabel von den Einheiten ab.

CAUTION:

Eine verbrauchte Lithiumbatterie nur durch eine Batterie mit der Teilenummer 45C1566 oder eine gleichwertige, vom Hersteller empfohlene Batterie ersetzen. Enthält das System ein Modul mit einer Lithiumbatterie, dieses nur durch ein Modul desselben Typs und von demselben Hersteller ersetzen. Die Batterie enthält Lithium und kann bei unsachgemäßer Verwendung, Handhabung oder Entsorgung explodieren.

Die Batterie nicht:

- mit Wasser in Berührung bringen.

- über 100 C erhitzen.
- reparieren oder zerlegen.

Die örtlichen Bestimmungen für die Entsorgung von Sondermüll beachten.

ACHTUNG:

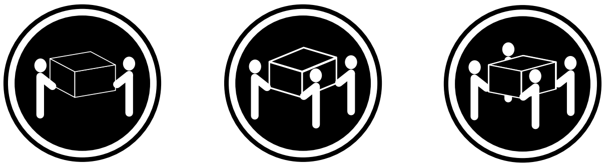
Bei der Installation von Lasergeräten (wie CD-ROM-Laufwerken, DVD- aufwerken, Einheiten mit Lichtwellenleitertechnik oder Sendern) Folgendes beachten:

- **Die Abdeckungen nicht entfernen. Durch Entfernen der Abdeckungen des Lasergeräts können gefährliche Laserstrahlungen freigesetzt werden. Das Gerät enthält keine zu wartenden Teile.**
- **Werden Steuerelemente, Einstellungen oder Durchführungen von Prozeduren anders als hier angegeben verwendet, kann gefährliche Laserstrahlung auftreten.**

VORSICHT

Einige Lasergeräte enthalten eine Laserdiode der Klasse 3A oder 3B. Beachten Sie Folgendes:

Laserstrahlung bei geöffneter Verkleidung. Nicht in den Strahl blicken. Keine Lupen oder Spiegel verwenden. Strahlungsbereich meiden.



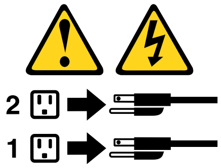
≥18 kg ≥32 kg ≥55 kg

ACHTUNG:

Arbeitsschutzrichtlinien beim Anheben der Maschine beachten.

ACHTUNG:

Mit dem Netzschalter an der Einheit und am Netzteil wird die Stromversorgung für die Einheit nicht unterbrochen. Die Einheit kann auch mit mehreren Netzkabeln ausgestattet sein. Um die Stromversorgung für die Einheit vollständig zu unterbrechen, müssen alle zum Gerät führenden Netzkabel vom Netz getrennt werden.



סכנה

זרם חשמלי המועבר בכבלי חשמל, טלפון ותקשורת הוא מסוכן.

כדי להימנע מסכנת התחשמלות:

- אל תחברו או תנתקו כבלים, ואל תבצעו פעולת התקנה, תחזוקה או שינוי תצורה במוצר זה במהלך סופת ברקים.
- חברו את כל כבלי החשמל לשקע חשמל מחווט ומוארק כהלכה.
- חברו כל ציוד שיחובר למוצר זה לשקעי חשמל מחווטים כהלכה.
- במידת האפשר, השתמשו ביד אחת בלבד לחיבור או לניתוק של כבלי אותות.
- לעולם אל תפעילו ציוד כלשהו כאשר יש עדות לנזק מבני או לנזק כתוצאה מאש או ממים.
- נתקו את כבלי החשמל, מערכות התקשורת, התקני הרשת והמודמים המחוברים לפני פתיחת כיסויי ההתקן, אלא אם הליכי ההתקנה וקביעת התצורה מורים אחרת.
- בעת התקנה, העברה או פתיחת כיסויים במוצר זה או בהתקנים המחוברים, חברו ונתקו את הכבלים כמתואר בטבלה שלהלן.

כדי לחבר	כדי לנתק
1. כבו הכל. 2. ראשית, חברו את כל הכבלים להתקנים. 3. חברו את כבלי האותות למחברים. 4. חברו את כבלי החשמל לשקעים. 5. הפעילו את ההתקן.	1. כבו הכל. 2. ראשית, נתקו את כבלי החשמל מהשקעים. 3. נתקו את כבלי האותות מהמחברים. 4. הסירו את כל הכבלים מההתקנים.

זהירות:
בעת החלפת סוללת הליתיום, השתמש רק בסוללה בעלת מק"ט 45C1566 או בסוג תואם שהומלץ על ידי היצרן. אם המערכת כוללת מודול המכיל סוללת ליתיום, החליפו אותו רק במודול מאותו סוג ומתוצרת אותו יצרן. הסוללה מכילה ליתיום, ועלולה להתפוצץ אם לא משתמשים ומטפלים בה או משליכים אותה כיאות.

לעולם:

- אל תטבלו במים
- אל תחממו לטמפרטורה הגבוהה מ-100°C (212°F)
- אל תתקנו או תפרקו

השליכו את הסוללה כנדרש לפי התקנות והחוקים המקומיים.

זהירות:

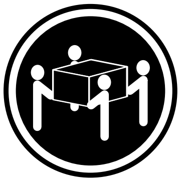
בעת התקנת מוצרי לייזר (כגון כונני תקליטורים ו-DVD, התקני סיב אופטי או משדרים), שימו לב לאזהרות הבאות:

- אל תסירו את הכיסויים. הסרת הכיסויים של מוצר הלייזר עלולה לגרום לחשיפה לקרינת לייזר מסוכנת. אין חלקים ברי טיפול בתוך ההתקן.
- שינויים, שימוש בבקרות או ביצוע הליכים אחרים מאלה המתוארים כאן, עלולים לגרום לחשיפה לקרינה מסוכנת.

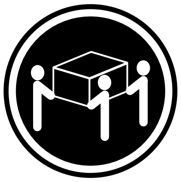
סכנה

מוצרי לייזר מסוימים מכילים דיודת לייזר מסוג Class 3A או Class 3B. שימו לב לאזהרה הבאה:

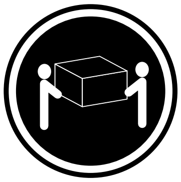
כאשר הוא פתוח, המוצר פולט קרינת לייזר. אל תביטו ישירות בקרן, אל תביטו ישירות בעזרת ציוד אופטי, והימענו מחשיפה לקרן.



≤55 ק"ג (121.2 ליב')



≤32 ק"ג (70.5 ליב')

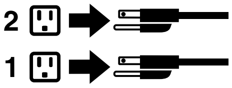


≤18 ק"ג (37 ליב')

זהירות:
השתמש בהליכים
הנאותים בעת
הרמת הציוד.

זהירות:

לחצן ההפעלה של ההתקן ומתג ההפעלה של ספק החשמל אינם מפסיקים את זרם החשמל המסופק להתקן. בנוסף, ההתקן עשוי לכלול יותר מכבל חשמל אחד. כדי לסלק את כל הזרם החשמלי מההתקן, ודאו שכל כבלי החשמל מנותקים ממקור החשמל.



PERICOLO

La corrente elettrica proveniente dai cavi di alimentazione, del telefono e di comunicazione può essere pericolosa.

Per evitare il rischio di scosse elettriche:

- **Non collegare o scollegare qualsiasi cavo oppure effettuare l'installazione, la manutenzione o la riconfigurazione del prodotto durante un temporale.**
- **Collegare tutti i fili elettrici a una presa di alimentazione correttamente cablata e dotata di messa a terra.**
- **Collegare alle prese elettriche appropriate tutte le apparecchiature che verranno utilizzate per questo prodotto.**
- **Se possibile, utilizzare solo una mano per collegare o scollegare i cavi di segnale.**
- **Non accendere assolutamente apparecchiature in presenza di incendi, perdite d'acqua o danno strutturale.**
- **Scollegare i cavi di alimentazione, i sistemi di telecomunicazione, le reti e il modem prima di aprire i coperchi del dispositivo, salvo istruzioni contrarie relative alle procedure di installazione e configurazione.**
- **Collegare e scollegare i cavi come descritto nella seguente tabella quando vengono effettuate operazioni di installazione, spostamento o apertura dei coperchi di questo prodotto o delle unità collegate.**

Per collegarsi	Per scollegarsi
1. SPEGNERE le apparecchiature. 2. Innanzitutto, collegare tutti i cavi alle unità. 3. Collegare i cavi di segnale ai connettori. 4. Collegare i cavi di alimentazione alla presa. 5. Accendere l'unità.	1. SPEGNERE le apparecchiature. 2. Innanzitutto, rimuovere i cavi di alimentazione dalla presa. 3. Rimuovere i cavi di segnale dai connettori. 4. Rimuovere tutti i cavi dalle unità.

ATTENZIONE:

Quando si sostituisce la batteria al litio, utilizzare solo il Numero parte 45C1566 o un tipo di batteria equivalente consigliato dal produttore. Se sul sistema è presente un modulo che contiene una batteria al litio, sostituirlo solo con un tipo di modulo dello stesso tipo della stessa casa di produzione. La batteria contiene litio e può esplodere se usata, maneggiata o smaltita in modo non corretto.

Non:

- **Gettare o immergere la batteria nell'acqua**
- **Riscaldarla ad una temperatura superiore ai 100 gradi C (212 gradi F)**
- **Smontarla, ricaricarla o tentare di ripararla**

Le batterie usate vanno smaltite in accordo alla normativa in vigore (DPR 915/82 e successive disposizioni e disposizioni locali).

ATTENZIONE:

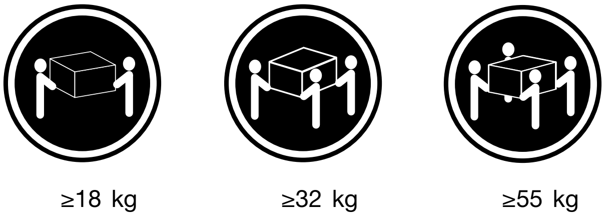
Quando vengono installati prodotti laser (quali CD-ROM, unità DVD-ROM, unità a fibre ottiche o trasmittenti), tener presente quanto segue:

- **Non rimuovere gli sportelli. L'apertura di un'unità laser può determinare l'esposizione a radiazioni laser pericolose. All'interno dell'unità non vi sono parti su cui effettuare l'assistenza tecnica.**
- **L'utilizzo di controlli, regolazioni o l'esecuzione di procedure non descritti nel presente manuale possono provocare l'esposizione a radiazioni pericolose.**

PERICOLO

Alcune unità laser contengono un diodo laser di Classe 3A o Classe 3B. Tener presente quanto segue:

Aprendo l'unità vengono emesse radiazioni laser. Non fissare il fascio, non guardarlo direttamente con strumenti ottici ed evitare l'esposizione al fascio.

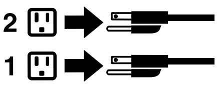


ATTENZIONE:

Prestare attenzione nel sollevare l'apparecchiatura.

ATTENZIONE:

Il pulsante di controllo dell'alimentazione presente sull'unità e l'interruttore dell'alimentatore non disattivano l'alimentazione corrente fornita all'unità. E' possibile che l'unità disponga di più cavi di alimentazione. Per disattivare l'alimentazione dall'unità, accertarsi che tutti i cavi di alimentazione siano scollegati dalla fonte di alimentazione.



위험

전원, 전화, 통신 케이블의 전류는 위험합니다.

감전의 위험을 피하려면 다음과 같이 하십시오.

- 번개가 치는 날에는 케이블을 연결 또는 분리하거나 본 제품을 설치, 보수, 재구성하지 마십시오.

- 모든 전원 코드는 올바르게 접지된 전기 콘센트에 연결하십시오.

- 본 제품에 연결될 장치는 올바르게 배선된 콘센트에 연결하십시오.

- 신호 케이블을 연결 또는 분리할 때 가능하면 한 손만을 사용하십시오.

- 불 또는 물로 인한 손상이나 구조적인 손상이 있을 경우 장치의 전원을 절대 켜지 마십시오.

- 설치 및 구성 과정에 별도의 지시 사항이 없는 경우, 장치의 덮개를 열기 전에 연결된 전원 코드, 원격 통신 시스템, 네트워크, 모뎀을 분리하십시오.

- 본 제품이나 연결된 장치를 설치, 이동하거나 덮개를 열 때 다음 표와 같은 순서로 케이블을 연결하거나 분리하십시오.

연결할 때:	분리할 때:
1. 모든 장치의 전원을 끄십시오. 2. 먼저 모든 케이블을 장치에 연결하십시오. 3. 커넥터에 신호 케이블을 연결하십시오. 4. 콘센트에 전원 코드를 연결하십시오. 5. 장치의 전원을 켜십시오.	1. 모든 장치의 전원을 끄십시오. 2. 먼저 콘센트에서 전원 코드를 분리하십시오. 3. 커넥터에서 신호 케이블을 분리하십시오. 4. 장치에서 모든 케이블을 분리하십시오.

주의:
배터리를 교환할 때는 Part Number 45C1566 또는 제조업체에서 지정한 동일한 종류의 제품을 사용하십시오. 사용자의 시스템이 리튬 배터리를 포함하는 모듈일 경우, 동일한 제조업체에서 동일한 모듈 유형으로 생산된 제품으로 교체하십시오. 배터리에는 리튬이 함유되어 있어 잘못 사용, 취급 또는 폐기할 경우 폭발의 위험이 있습니다.

사고를 방지하려면 다음 사항을 준수하십시오.

- 배터리를 물 속에 던지거나 침수시키지 마십시오.

- 100℃(212°F) 이상 가열하지 마십시오.

- 수리하거나 분해하지 마십시오.

배터리를 폐기할 때는 법령 또는 회사의 안전 수칙에 따라 폐기하십시오.

주의:
CD-ROM, DVD-ROM 장치, 광섬유 장치 또는 송신 장치와 같은 레이저 제품을 설치할 때, 다음과 같은 취급 주의사항을 참고하십시오.

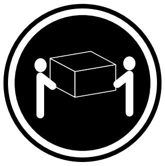
– 덮개를 열지 마십시오. 덮개를 열면 레이저 복사 에너지에 노출될 위험이 있습니다. 장치 내부에는 사용자가 조정하거나 수리할 수 있는 부품이 없습니다.

– 규정된 것 이외의 절차 수행, 제어 조정 등의 행위로 인해 해로운 레이저 복사에 노출될 수 있습니다.

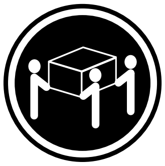
위험

일부 장비에는 임베디드 클래스 3A 또는 클래스 3B 레이저 다이오드가 있습니다. 다음 주의사항에 유의하십시오.

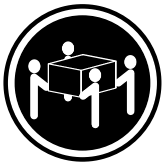
드라이브가 열리면 레이저 복사 에너지가 방출됩니다. 광선이 눈에 직접 쏘이지 않도록 하십시오. 나안 또는 광학 기구를 착용한 상태에서 광선을 직접 바라보지 않도록 하십시오.



≥18 kg (37 lbs)



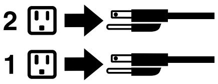
≥32 kg (70.5 lbs)



≥55 kg (121.2 lbs)

주의:
제품을 들어 올릴 때
안전 규제를 따르십시오.

주의:
장치의 전원 제어 버튼 및 전원 공급 장치의 전원 스위치를 사용하여 장치에 공급되는 전기를 차단하지 마십시오. 장치는 둘 이상의 코드를 가지고 있을 수 있습니다. 장치에서 모든 전원을 차단하려면 콘센트에서 코드가 모두 분리되어 있는지 확인하십시오.



PELIGRO

La corriente eléctrica procedente de cables de alimentación, teléfonos y cables de comunicación puede ser peligrosa.

Para evitar el riesgo de descarga eléctrica:

- **No conecte ni desconecte los cables ni realice ninguna tarea de instalación, mantenimiento o reconfiguración de este producto durante una tormenta eléctrica.**
- **Conecte todos los cables de alimentación a tomas de corriente debidamente cableadas y conectadas a tierra.**
- **Cualquier equipo que se conecte a este producto también debe conectarse a tomas de corriente debidamente cableadas.**
- **Siempre que sea posible, utilice una sola mano para conectar o desconectar los cables de señal.**

- **No encienda nunca un equipo cuando hay señales de fuego, agua o daños estructurales.**
- **Desconecte los cables de alimentación, los sistemas de telecomunicaciones, las redes y los módems conectados antes de abrir las cubiertas de los dispositivos, a menos que se indique lo contrario en los procedimientos de instalación y configuración.**
- **Conecte y desconecte los cables, como se describe en la tabla siguiente, cuando instale, mueva o abra las cubiertas de este producto o de los dispositivos conectados.**

Para conectar	**Para desconectar**
1. APÁGUELO todo. 2. En primer lugar, conecte todos los cables a los dispositivos. 3. Conecte los cables de señal a los conectores. 4. Enchufe los cables de alimentación a las tomas de corriente. 5. Encienda el dispositivo.	1. APÁGUELO todo. 2. En primer lugar, desenchufe los cables de alimentación de las tomas de corriente. 3. Desconecte los cables de señal de los conectores. 4. Desconecte todos los cables de los dispositivos.

⚠

PRECAUCIÓN:

Cuando sustituya una batería de litio, utilice solamente una batería número de pieza 45C1566 u otra de tipo equivalente recomendada por el fabricante. Si su sistema dispone de un módulo que contiene una batería de litio, reemplácelo sólo con el mismo tipo de módulo, del mismo fabricante. La batería contiene litio y puede explotar si no se utiliza, manipula o desecha correctamente.

No debe:

- **Arrojarla al agua o sumergirla en ella**
- **Exponerla a temperaturas superiores a 100°C (212°F)**
- **Repararla o desmontarla**

Deshágase de la batería según especifiquen las leyes o normas locales.

⚠

PRECAUCIÓN:

Cuando haya productos láser (como unidades de CD-ROM, unidades de DVD, dispositivos de fibra óptica o transmisores) instalados, tenga en cuenta lo siguiente:

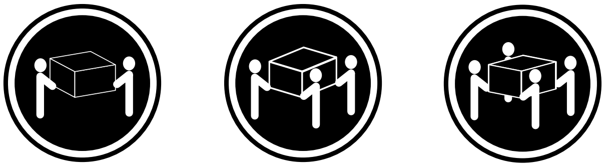
- **No quite las cubiertas. Si quita las cubiertas del producto láser, podría quedar expuesto a radiación láser peligrosa. Dentro del dispositivo no existe ninguna pieza que requiera servicio técnico.**
- **Si usa controles o ajustes o realiza procedimientos que no sean los especificados aquí, podría exponerse a radiaciones peligrosas.**

⚠

PELIGRO

Algunos productos láser tienen incorporado un diodo láser de clase 3A o clase 3B. Tenga en cuenta lo siguiente:

Cuando se abre, queda expuesto a radiación láser. No mire directamente al rayo láser, ni siquiera con instrumentos ópticos, y evite exponerse directamente al rayo láser.



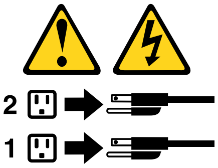
≥18 kg ≥32 kg ≥55 kg

PRECAUCIÓN:

Adopte procedimientos seguros al levantar el equipo.

PRECAUCIÓN:

El botón de control de alimentación del dispositivo y el interruptor de alimentación de la fuente de alimentación no desconectan la corriente eléctrica suministrada al dispositivo. Además, el dispositivo podría tener más de un cable de alimentación. Para suprimir toda la corriente eléctrica del dispositivo, asegúrese de que todos los cables de alimentación estén desconectados de la toma de corriente.



Chapter 3. General information

This chapter provides general information that applies to all machine types supported by this publication.

Specifications

This section lists the physical specifications for your computer.

For machine types: 30A0 and 30A1

Dimensions

Width: 175 mm (6.89 inches)
Height: 425 mm (16.73 inches)
Depth: 431 mm (16.97 inches)

Weight

Maximum configuration as shipped: 13 kg (28.66 lb)

Environment

- Air temperature:
  - Operating: 10°C to 35°C (50°F to 95°F)
  - Storage: -40°C to 60°C (-40°F to 140°F) in original shipping package
  - Storage: -10°C to 60°C (14°F to 140°F) without package
- Humidity:
  - Operating: 20% to 80% (non-condensing)
  - Storage: 20% to 90% (non-condensing)
- Altitude:
  - Operating: -15.2 to 3048 m (-50 to 10 000 ft)
  - Storage: -15.2 to 10 668 m (-50 to 35 000 ft)

Electrical input

- Input voltage:
  - Low range:
    - Minimum: 100 V ac
    - Maximum: 127 V ac
    - Input frequency range: 50 to 60 Hz
  - High range:
    - Minimum: 200 V ac
    - Maximum: 240 V ac
    - Input frequency range: 50 to 60 Hz

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For machine types: 30A2 and 30A3

Dimensions

Width: 102 mm (4.02 inches)

Height: 338 mm (13.31 inches)

Depth: 375 mm (14.76 inches)

Weight

Maximum configuration as shipped: 7.8 kg (17.20 lb)

Environment

- Air temperature:

  Operating: 10°C to 35°C (50°F to 95°F)

  Storage: -40°C to 60°C (-40°F to 140°F) in original shipping package

  Storage: -10°C to 60°C (14°F to 140°F) without package
- Humidity:

  Operating: 20% to 80% (non-condensing)

  Storage: 20% to 90% (non-condensing)
- Altitude:

  Operating: -15.2 to 3048 m (-50 to 10 000 ft)

  Storage: -15.2 to 10 668 m (-50 to 35 000 ft)

Electrical input

- Input voltage:
  - Low range:

    Minimum: 100 V ac

    Maximum: 127 V ac

    Input frequency range: 50 to 60 Hz
  - High range:

    Minimum: 200 V ac

    Maximum: 240 V ac

    Input frequency range: 50 to 60 Hz

Lenovo programs

Your computer comes with Lenovo programs to help you work more easily and securely. Depending on the Windows operating system preinstalled, the programs might vary.

Accessing Lenovo programs on the Windows 7 operating system

You can access Lenovo programs on the Microsoft Windows 7 operating system through Windows Search or from Control Panel. The icon name displayed in the search result or Control Panel might be different from the program name. You can find the program by its program name or icon name as shown in the *Lenovo programs available on the Windows 7 operating system* table.

Note: If you do not find the program you need, open the Lenovo ThinkVantage® Tools program to find the dimmed icon for the program. Then double-click the icon to install the program.

To access Lenovo programs through Windows Search, do the following:

1. Click the **Start** button and then type the program name or the icon name into the search box.
2. Locate the program by the program name or the icon name and then click the program to launch it.

To access Lenovo programs from Control Panel, do the following:

Note: Some Lenovo programs might not be displayed in Control Panel. To find these programs, use Windows Search.

1. Click **Start** → **Control Panel**. Change the view of Control Panel from Category to Large icons or Small icons.
2. Locate the program by the icon name and then click the program to launch it.

The following table lists the programs available on the Windows 7 operating system.

Note: Depending on your computer model, some of the Lenovo programs might not be available.

Table 1. Lenovo programs available on the Windows 7 operating system

Program name	**Icon name**
Lenovo Reach	Lenovo Reach
Lenovo SHAREit	Lenovo SHAREit
Lenovo Solution Center	Lenovo - System Health and Diagnostics
Recovery Media	Lenovo - Factory Recovery Disks or Create Recovery Media
Rescue and Recovery®	Lenovo - Enhanced Backup and Restore
System Update	Lenovo - Update and Drivers

Accessing Lenovo programs on the Windows 8 or Windows 8.1 operating system

If your computer is preinstalled with the Windows 8 or Windows 8.1 operating system, you can access Lenovo programs by doing one of the following:

- On the Windows 8 operating system, press the Windows key ⊞ to go to the Start screen. Click a Lenovo program to launch it. If you cannot find the program you need, move the pointer to the bottom-right corner of the screen to display the charms. Then click the **Search** charm to search for the desired program.
- On the Windows 8.1 operating system, press the Windows key ⊞ to go to the Start screen. Click a Lenovo program to launch it. If you cannot find the program you need, click the arrow icon ⬇ in the bottom-left corner of the screen to go to the Apps screen. Find the desired program in the apps list or search for it in the search box in the top-right corner of the screen.

Depending on your computer model, your computer supports some of the following Lenovo programs:

- Lenovo Companion
- Lenovo Reach
- Lenovo SHAREit
- Lenovo Solution Center
- Lenovo Support
- Lenovo Tools

Lenovo Support Web site

Technical support information is available on the Lenovo Support Web site at:
http://www.lenovo.com/support

This Web site is updated with the latest support information such as the following:

- Drivers and software
- Diagnostic solutions
- Product and service warranty
- Product and parts details
- User guides and manuals
- Knowledge base and frequently asked questions

Chapter 4. General checkout

Attention

The drives in the computer you are servicing might have been rearranged or the drive startup sequence changed. Be extremely careful during write operations such as copying, saving, or formatting. Data or programs can be overwritten if you select an incorrect drive.

General error messages appear if a problem or conflict is found by an application program, the operating system, or both. For an explanation of these messages, refer to the information supplied with that software package.

Before replacing any FRUs, ensure that the latest level of BIOS is installed on the system. A down-level BIOS might cause false errors and unnecessary replacement of the system board. For more information on how to determine and obtain the latest level BIOS, see "BIOS levels" on page 219.

Use the following procedure to help determine the cause of the problem:

1. Power-off the computer and all external devices.
2. Check all cables and power cords.
3. Set all display controls to the middle position.
4. Power-on all external devices.
5. Power-on the computer.
   - Look for displayed error codes
   - Listen for beep codes
   - Look for readable instructions or a main menu on the display.

   If you *did not* receive the correct response, proceed to step 6.

   If you *do* receive the correct response, proceed to step 7.
6. Look at the following conditions and follow the instructions:
   - If you hear beep codes during POST, go to "Beep symptoms" on page 63.
   - If the computer displays a POST error, go to "POST error codes" on page 64.
   - If the computer hangs and no error is displayed, continue at step 7.
7. Run the Diagnostic programs. See "Diagnostics" on page 53.
   - If you receive an error, replace the part that the diagnostic program calls out.
   - If the test stops and you cannot continue, replace the last device tested.

Problem determination tips

Due to the variety of hardware and software combinations that can be encountered, use the following information to assist you in problem determination. If possible, have this information available when requesting assistance from Service Support and Engineering functions.

- Machine type and model
- Processor or hard disk drive upgrades
- Failure symptom
  - Do diagnostics indicate a failure?
  - What, when, where, single, or multiple systems?
  - Is the failure repeatable?

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  - Has this configuration ever worked?
  - If it has been working, what changes were made prior to it failing?
  - Is this the original reported failure?
- Diagnostics version
  - Type and version level
- Hardware configuration
  - Print (print screen) configuration currently in use
  - BIOS level
- Operating system software
  - Type and version level

Notes: To eliminate confusion, identical systems are considered identical only if they:

1. Are the exact machine type and models
2. Have the same BIOS level
3. Have the same adapters/attachments in the same locations
4. Have the same address jumpers/terminators/cabling
5. Have the same software versions and levels
6. Have the same Diagnostic Diskettes (version)
7. Have the same configuration options set in the system
8. Have the same setup for the operating system control files

Comparing the configuration and software set-up between “working and non-working” systems will often lead to problem resolution.

Chapter 5. Troubleshooting and diagnostics

This chapter provides information about diagnosing and troubleshooting computer problems. If your computer problem is not described here, see "Lenovo Support Web site" on page 32 for additional troubleshooting resources.

Basic troubleshooting

The following table provides information to help you troubleshoot your computer problems.

Note: If you cannot correct the problem, have the computer serviced. For a list of service and support telephone numbers, refer to the *Safety, Warranty, and Setup Guide* that comes with your computer or go to the Lenovo Support Web site at http://www.lenovo.com/support/phone.

Symptom	Action
The computer does not start when you press the power switch.	Verify that: • The power cord is correctly connected to the rear of the computer and to a working electrical outlet. • If your computer has a secondary power switch on the rear of the computer, ensure that it is switched on. • The power indicator on the front of the computer is on. • The computer voltage matches the voltage available at the electrical outlet for your country or region.
The monitor screen is blank.	Verify that: • The monitor signal cable is correctly connected to the monitor and to the appropriate monitor connector on the computer. • The monitor power cord is correctly connected to the monitor and to a working electrical outlet. • The monitor is turned on and the brightness and contrast controls are set correctly. • The computer voltage matches the voltage available at the electrical outlet for your country or region. • If your computer has two monitor connectors, be sure to use the connector on the graphics card.
The keyboard does not work.	Verify that: • The computer is turned on. • The keyboard is securely connected to a USB connector on the computer. • No keys are stuck.
The mouse does not work.	Verify that: • The computer is turned on. • The mouse is securely connected to a USB connector on the computer. • The mouse is clean. Refer to "Optical mouse" on page 43 for further information.

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Symptom	Action
The operating system does not start.	Verify that: • The startup sequence includes the device where the operating system resides. Usually, the operating system is on the hard disk drive. For more information, see "Selecting a startup device" on page 57.
The computer beeps multiple times before the operating system starts.	Verify that no keys are stuck.

Accessing Control Panel on the Windows 8 or Windows 8.1 operating system

On the Windows operating system, you can view and change computer settings through Control Panel. To access Control Panel on the Windows 8 or Windows 8.1 operating system, do one of the following:

- From the desktop
  1. Move the pointer to the top-right or bottom-right corner of the screen to display the charms.
  2. Click **Settings**.
  3. Click **Control Panel**.
- From the Start screen
  - For Windows 8:
    1. Move the pointer to the top-right or bottom-right corner of the screen to display the charms.
    2. Click **Search**.
    3. On the Apps screen, scroll to the right side, and click **Control Panel** in the **Windows System** section.
  - For Windows 8.1:
    1. Click the arrow icon ⬇ in the bottom-left corner of the screen to go to the Apps screen.
    2. Scroll to the right side, and click **Control Panel** in the **Windows System** section.

Troubleshooting procedure

Use the following procedure as a starting point for diagnosing problems you are experiencing with your computer:

1. Verify that the cables for all attached devices are connected correctly and securely.
2. Verify that all attached devices that require ac power are connected to properly grounded, functioning electrical outlets.
3. Verify that all attached devices are enabled in the BIOS settings of your computer. For more information about accessing and changing the BIOS settings, refer to your Chapter 6 "Using the Setup Utility program" on page 55.
4. Go to the "Troubleshooting" on page 37 and follow the instructions for the type of problem you are experiencing. If the Troubleshooting information does not help you resolve a problem, continue with the next step.
5. Try using a previously captured configuration to see if a recent change to hardware or software settings has caused a problem. Before restoring a previous configuration, capture your current configuration in case the older configuration settings do not solve the problem or have adverse affects. To restore a captured configuration, do the following:
   - For Windows 7: Click **Start → Control Panel → System and Security → System → System Protection → System Restore**.

  - For Windows 8 or Windows 8.1: Open Control Panel, and then click **System and Security** → **System** → **System Protection** → **System Restore**.

  If this does not correct the problem, continue with the next step.

6. Run the diagnostic program. See "Lenovo Solution Center" on page 54 for more information.
   - If the diagnostic program detects a hardware failure, contact the Lenovo Customer Support Center. See "Lenovo Support Web site" on page 32 for more information.
   - If you are unable to run the diagnostic program, contact the Lenovo Customer Support Center. See "Lenovo Support Web site" on page 32 for more information.
   - If the diagnostic program does not detect a hardware failure, continue with the next step.
7. Use an antivirus program to see if your computer has been infected by a virus. If the program detects a virus, remove the virus.
8. If none of these actions solve the problem, seek technical assistance. See "Lenovo Support Web site" on page 32 for more information.

Troubleshooting

Use the troubleshooting information to find solutions to problems that have definite symptoms.

If the symptom your computer is experiencing occurred immediately after you installed a new hardware option or new software, do the following before referring to the troubleshooting information:

1. Remove the new hardware option or software. If you must remove the computer cover to remove a hardware option, ensure that you review and follow the electrical safety information provided with your computer. For your safety, do not operate the computer with the cover removed.
2. Run the diagnostic program to ensure that your computer is operating correctly.
3. Reinstall the new hardware option or software following the manufacturer's instructions.

Select the problem your computer is experiencing from the following list:

- "Audio problems" on page 37
- "CD problems" on page 39
- "DVD problems" on page 40
- "Intermittent problems" on page 41
- "Keyboard, mouse, or pointing device problems" on page 42
- "Monitor problems" on page 44
- "Networking problems" on page 46
- "Option problems" on page 49
- "Performance and lockup problems" on page 49
- "Printer problems" on page 51
- "Serial port problems" on page 52
- "Software problems" on page 52
- "USB problems" on page 53

Audio problems

Select your symptom from the following list:

- "No audio in Windows" on page 38

- “An audio disc or AutoPlay-enabled disc does not automatically play when it is inserted into a drive” on page 38
- “Sound comes from one external speaker only” on page 38
- “No audio in DOS applications or games” on page 39

No audio in Windows

Symptom: No audio in Windows

Actions:

- If you are using powered external speakers that have an On/Off control, verify that the On/Off control is set to the **On** position and the speaker power cable is connected to a properly grounded, functional ac electrical outlet.
- If your external speakers have a volume control, verify that the volume control is not set too low.
- Click the speaker icon in the Windows desktop notification area. A volume-control window opens. Press **Mixer** to open the Volume Mixer window. Verify that the speaker mute buttons are not pressed and the volume settings are not set too low.
- Some models have a front audio panel you can use to adjust volume. If you have a front audio panel, verify that the volume is not set too low.
- Verify that your external speakers (and headphones, if used) are connected to the correct audio connector on the computer. Most speaker cables are color-coded to match the connector.

Note: When external-speaker or headphone cables are attached to the audio connector, the internal speaker, if present, is disabled. In most cases, if an audio adapter is installed in one of the expansion slots, the audio function built into the system board is disabled; use the audio jacks on the adapter.

- Ensure that the program you are running is designed for use in the Microsoft Windows operating system. If the program is designed to run in DOS, the program does not use the Windows sound feature and must be configured to use SoundBlaster Pro or SoundBlaster emulation.
- Verify that the audio device drivers are correctly installed. See Microsoft Windows help system for more information.

If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see “Lenovo Support Web site” on page 32.

An audio disc or AutoPlay-enabled disc does not automatically play when it is inserted into a drive

Symptom: An audio disc or AutoPlay-enabled disc does not automatically play when it is inserted into a drive

Action: See “CD problems” on page 39.

Sound comes from one external speaker only

Symptom: Sound comes from one external speaker only.

Actions:

- Ensure that the speaker cable is inserted completely into the connector on the computer.
- Ensure that the cable that attaches the left speaker to the right speaker is securely connected.
- Right-click the speaker icon in the Windows desktop notification area, and then click **Playback devices**. Click the **Playback** tab, select Speakers, and then click **Properties**. Click **Balance** on the **Levels** tab, and verify that the Balance setting is set correctly.

If these actions do not correct the problem, you might have a failing speaker. Have the speaker serviced. If you need technical assistance, see "Lenovo Support Web site" on page 32.

No audio in DOS applications or games

Symptom: No audio in DOS applications or games

Actions:

- Ensure that the DOS application or game is configured to use SoundBlaster Pro or SoundBlaster emulation. Refer to the documentation that comes with the application or game for instructions on setting sound-card settings.
- If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see "Lenovo Support Web site" on page 32.

CD problems

Select your symptom from the following list:

- "An audio disc or AutoPlay-enabled disc does not automatically play when it is inserted into a CD drive" on page 39
- "A CD or DVD does not work" on page 39
- "Unable to use a startable (bootable) recovery medium, such as the Product Recovery CD, to start your computer" on page 40

An audio disc or AutoPlay-enabled disc does not automatically play when it is inserted into a CD drive

Symptom: An audio disc or AutoPlay-enabled disc does not automatically play when it is inserted into a CD drive.

Actions:

- If you have multiple CD or DVD drives installed (or a combination of CD and DVD drives), try inserting the disc into the other drive. In some cases, only one of the drives is connected to the audio subsystem.
- If you are using the Windows 7 operating system, follow the action for "A CD or DVD does not work" on page 39.

If this does not correct the problem, follow the action for "A CD or DVD does not work" on page 39.

A CD or DVD does not work

Symptom: A CD or DVD does not work.

Actions:

- Verify that the disc is inserted correctly, with its label up.
- Ensure that the disc you are using is clean. To remove dust or fingerprints, wipe the disc clean with a soft cloth from the center to the outside. Wiping a disc in a circular motion might cause loss of data.
- Verify that the disc you are using is not scratched or damaged. Try inserting another disc that you know is good. If you cannot read from a known-good disc, you might have a problem with your CD or DVD drive or the cabling to your CD or DVD drive. Ensure that the power cable and signal cable are securely connected to the drive.

Unable to use a startable (bootable) recovery medium, such as the Product Recovery CD, to start your computer

Symptom: Unable to use a startable (bootable) recovery medium, such as the Product Recovery CD, to start your computer.

Action: Ensure that the CD or DVD drive is in the startup sequence before the hard disk drive. Refer to your "Selecting or changing the startup device sequence" on page 58 for information on viewing and changing the startup sequence. Note that on some models the startup sequence is permanently set and cannot be changed.

If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see "Lenovo Support Web site" on page 32.

DVD problems

Select your symptom from the following list:

- "Black screen instead of DVD video" on page 40
- "DVD movie will not play" on page 40
- "No audio or intermittent audio while playing DVD movie" on page 40
- "Playback is very slow or choppy" on page 41
- "Invalid disc or no disc found message" on page 41

Black screen instead of DVD video

Symptom: Black screen instead of DVD video

Actions:

- Restart the DVD player program.
- Close any open files, turn off the computer, and then restart the computer.
- Try a lower screen resolution or color depth.

If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see "Lenovo Support Web site" on page 32.

DVD movie will not play

Symptom: DVD movie will not play.

Actions:

- Ensure that the disc surface is clean and not scratched.
- Check the disc or package for regional coding. You might need to purchase a disc with coding for the region where you are using your computer.

If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see "Lenovo Support Web site" on page 32.

No audio or intermittent audio while playing DVD movie

Symptom: No audio or intermittent audio while playing DVD movie.

Actions:

- Check the volume control settings on your computer and on your speakers.

- Ensure that the disc surface is clean and not scratched.
- Check all cable connections to and from the speakers.
- Use the DVD menu for the video to select a different audio track.

If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see “Lenovo Support Web site” on page 32.

Playback is very slow or choppy

Symptom: Playback is very slow or choppy.

Actions:

- Disable any background programs, such as AntiVirus or Desktop Themes.
- Ensure that video resolution is set to less than 1152 x 864.

If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see “Lenovo Support Web site” on page 32.

Invalid disc or no disc found message

Symptom: Invalid disc or no disc found message

Actions:

- Ensure that a DVD disc is in the drive with the shiny side of the disc facing down.
- Ensure that video resolution is set to less than 1152 x 864.
- On computers that have a CD-ROM or CD-RW drive in addition to a DVD-ROM drive, ensure that the DVD disc is in the drive labeled “DVD”.

If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see “Lenovo Support Web site” on page 32.

Intermittent problems

Symptom: A problem occurs only occasionally and is difficult to repeat.

Actions:

- Verify that all cables and cords are securely connected to the computer and attached devices.
- Verify that when the computer is on, the fan grill is not blocked (there is air flow around the grill), and the fans are working. If airflow is blocked or the fans are not working, the computer might overheat.
- If SCSI devices are installed, verify that the last external device in each SCSI chain is terminated correctly. (See your SCSI documentation.)

If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see “Lenovo Support Web site” on page 32.

Hard disk drive problems

Select your symptom from the following list:

- “Some or all hard disk drives missing from the Setup Utility program” on page 42
- “"No Operating System Found" message or the system not starting from the correct hard disk drive” on page 42

Some or all hard disk drives missing from the Setup Utility program

Symptom: Some or all hard disk drives missing from the Setup Utility program

Actions:

- Ensure that all hard disk drive signal cables and power cables are connected correctly.
- Ensure that your computer is configured correctly to support the hard disk drives.
  - If your computer is installed with five SATA hard disk drives, ensure that the SATA hard disk drive enablement module (one to five hard disk drives) is installed.
  - If your computer is installed with SAS hard disk drives, ensure that the SAS hard disk drive enablement module (one to five hard disk drives) or the LSI MegaRAID SAS adapter is installed.

If these actions do not correct the problem, run the diagnostic program Lenovo Solution Center. See "Lenovo Solution Center" on page 54. If you need technical assistance, see "Lenovo Support Web site" on page 32.

"No Operating System Found" message or the system not starting from the correct hard disk drive

Symptom: "No Operating System Found" message or the system not starting from the correct hard disk drive

Actions:

- Ensure that all hard disk drive signal cables and power cables are connected correctly. For computer models 30A0 and 30A1, refer to "Replacing the primary hard disk drive" on page 123. For computer models 30A2 and 30A3, refer to "Replacing the hard disk drive" on page 169.
- Ensure that the hard disk drive your computer starts from is listed as the first startup device in the Setup Utility program. Refer to "Selecting a startup device" on page 57.
- If you are using RAID, ensure that you have configured the hard disk drives correctly. Refer to Chapter 7 "Configuring RAID" on page 61.

Note: In rare cases, the hard disk drive with the operating system might get corrupted or damaged. In such cases, you might need to replace the hard disk drive. For computer models 30A0 and 30A1, refer to "Replacing the primary hard disk drive" on page 123. For computer models 30A2 and 30A3, refer to "Replacing the hard disk drive" on page 169.

If these actions do not correct the problem, run the diagnostic program Lenovo Solution Center. See "Lenovo Solution Center" on page 54. If you need technical assistance, see "Lenovo Support Web site" on page 32.

Keyboard, mouse, or pointing device problems

Select your symptom from the following list:

- "All or some keys on the keyboard do not work" on page 42
- "The mouse or pointing device does not work" on page 43
- "The pointer on the screen does not move smoothly with the mouse" on page 44
- "The fingerprint reader does not work" on page 44
- "The wireless keyboard does not work" on page 44

All or some keys on the keyboard do not work

Symptom: All or some keys on the keyboard do not work.

Actions:

- Verify that the keyboard cable is securely connected to the correct connector on the computer.

- If you are using an Enhanced Performance USB keyboard and one or more of the Rapid Access buttons are the only keys that are not working, these buttons might have been disabled or have not been assigned to a function. Use the help system in the Enhanced Performance Customization Keyboard program to help diagnose problems with the Rapid Access buttons.

  To open the Enhanced Performance Customization Keyboard program, do one of the following:

  – On the Windows 7 operating system, do the following:
    1. Click **Start** → **Control Panel**.
    2. Click **Hardware and Sound**.
    3. Click **Devices and Printers**.
    4. Double-click **USB Enhanced Performance Keyboard**. The USB Enhanced Performance Keyboard Customization program starts.

  – On the Windows 8 or Windows 8.1 operating system, do the following:
    1. Open Control Panel.
    2. Click **Hardware and Sound**.
    3. Click **Devices and Printers**.
    4. Double-click **USB Enhanced Performance Keyboard**. The USB Enhanced Performance Keyboard Customization program starts.

If these actions do not correct the problem, have the computer and keyboard serviced. See "Lenovo Support Web site" on page 32 for details.

The mouse or pointing device does not work

Symptom: The mouse or pointing device does not work.

Actions:

- Verify that the mouse or pointing-device cable is securely attached to the correct connector on the computer. Depending on the type of mouse you have, the mouse cable will connect to either the mouse, serial, or USB connector. Some keyboards have integrated USB connectors that can be used for a USB mouse or pointing device.
- Verify that the device drivers for the mouse or pointing device are installed correctly.
- If you are using a USB keyboard or mouse, verify that the USB connectors are enabled in the BIOS settings. See "Enabling or disabling a device" on page 57.

If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see "Lenovo Support Web site" on page 32.

Optical mouse

This section provides instructions on how to clean an optical mouse.

An optical mouse uses a light-emitting diode (LED) and an optical sensor to navigate the pointer. If the pointer on the screen does not move smoothly with the optical mouse, you might need to clean the mouse.

To clean an optical mouse, do the following:

1. Turn off your computer.
2. Disconnect the mouse cable from the computer.
3. Turn the mouse upside down to check the lens.
   a. If there is a smudge on the lens, gently clean the area with a plain cotton-tipped swab.

   b. If there is debris in the lens, gently blow the debris away from the area.

4. Check the surface on which you are using the mouse. If you have a very intricate picture or pattern beneath the mouse, it may be difficult for the digital signal processor (DSP) to determine changes in the mouse position.
5. Reconnect the mouse cable to the computer.
6. Turn your computer back on.

The pointer on the screen does not move smoothly with the mouse

Symptom: The pointer on the screen does not move smoothly with the mouse.

Action: Erratic movement of the mouse pointer is generally caused by a buildup of dirt, oils, and other contaminants on the ball inside the mouse. Clean the mouse. See "Optical mouse" on page 43 for instructions.

The fingerprint reader does not work

Symptom: The fingerprint reader does not work.

Action: The following could cause the fingerprint reader not to operate properly:

- Not enrolling your fingerprint correctly.
- Scratching the surface of the reader with a hard, pointed object.
- Scraping the surface of the reader with your nail or anything hard.
- Using or touching the reader with a dirty finger.
- The surface of your finger is very different from when you enrolled your fingerprint.

The wireless keyboard does not work

Symptom: The wireless keyboard does not work.

Action: If the Transceiver Communications LED is on and the wireless Keyboard does not work, restart your computer. If restarting your computer does not solve the problem, verify that the following conditions are met:

- The batteries are properly installed.
- The batteries still retain their current.
- The wireless Keyboard is located less than ten meters away from the transceiver.
- The transceiver is fully installed.

Action: If the Transceiver Communications LED is not on, reconnect the transceiver and the keyboard.

Monitor problems

Note: Many monitors have status-indicator lights and built-in controls for adjusting brightness, contrast, width, height, and other picture adjustments. However, the controls vary from monitor type to monitor type. For information about the status lights and using the controls, refer to the documentation that comes with your monitor.

Select your symptom from the following list:

- "Wrong characters appear on the screen" on page 45
- "The monitor works when you turn on the computer, but goes blank after some period of computer inactivity" on page 45
- "The monitor works when you turn on the computer, but goes blank when you start some application programs" on page 45

- “The image appears to be flickering” on page 45
- “The image is discolored” on page 46

Wrong characters appear on the screen

Symptom: Wrong characters appear on the screen.

Action: Have the computer serviced. For details, see “Lenovo Support Web site” on page 32.

The monitor works when you turn on the computer, but goes blank after some period of computer inactivity

Symptom: The monitor works when you turn on the computer, but goes blank after some period of computer inactivity.

Action: The computer is probably set for energy savings with the power-management feature. If the power-management feature is enabled, disabling it or changing the settings might solve the problem.

If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see “Lenovo Support Web site” on page 32.

The monitor works when you turn on the computer, but goes blank when you start some application programs

Symptom: The monitor works when you turn on the computer, but goes blank when you start some application programs.

Actions:

- Ensure that the monitor signal cable is securely connected to the monitor and the monitor connector on the computer. A loose cable can cause intermittent problems.
- Verify that the necessary device drivers for the application programs are installed. Refer to the documentation for the affected application program to see if device drivers are required.

If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see “Lenovo Support Web site” on page 32.

The image appears to be flickering

Symptom: The image appears to be flickering.

Actions:

- The monitor might be operating in a low-refresh rate display mode. Set the monitor to the highest, noninterlaced refresh rate supported by your monitor and the video controller in your computer.

  Attention: Using a resolution or refresh rate that is not supported by your monitor might damage it. Check the documentation that comes with your monitor to verify the supported refresh rates.

- The monitor might be affected by interference from nearby equipment. Magnetic fields around other devices, such as transformers, appliances, fluorescent lights, and other monitors might be causing the problem. Move fluorescent desk lighting or any equipment that produces magnetic fields farther away from the monitor. If this does not correct the problem, do the following:
  1. Turn off the monitor. (Moving a color monitor while it is turned on might cause screen discoloration.)
  2. Adjust the placement of the monitor and other devices so that they are at least 305 mm (12 inches) apart.
  3. Turn on the monitor.

- You can reset the refresh rate through your operating system Control Panel:

  On the Windows 7 operating system, click **Start → Control Panel → Hardware and Sound → Adjust screen resolution → Advanced Settings**. Then click the **Monitor** tab and select a new refresh rate.

  On the Windows 8 or Windows 8.1 operating system, open Control Panel and click **Hardware and Sound → Adjust screen resolution → Advanced Settings**. Then click the **Monitor** tab and select a new refresh rate.
- See your operating system documentation or help for further information on monitor settings.

If these actions do not correct the problem, your monitor might need service. See "Lenovo Support Web site" on page 32 for details.

The image is discolored

Symptom: The image is discolored.

Action: The monitor might be affected by interference from nearby equipment. Magnetic fields around other devices, such as transformers, appliances, fluorescent lights, and other monitors might be causing the problem. Move fluorescent desk lighting or any equipment that produces magnetic fields further away from the monitor. If this does not correct the problem, do the following:

1. Turn off the monitor. (Moving a color monitor while it is turned on might cause screen discoloration.)
2. Adjust the placement of the monitor and other devices so that they are at least 305 mm (12 inches) apart.
3. Turn on the monitor.

If these actions do not correct the problem, your monitor might need service. See "Lenovo Support Web site" on page 32 for details.

Networking problems

The following are the most common networking problems. Select your networking problem from the following list:

- "Ethernet problems" on page 46
- "A wireless LAN problem" on page 48
- "A wireless WAN problem" on page 48
- "Bluetooth problem" on page 48

Ethernet problems

For Ethernet problems, select your symptom from the following list:

- "Your computer cannot connect to the network" on page 46
- "The adapter stops working for no apparent reason" on page 47
- "If your computer is a Gigabit Ethernet model and you use a speed of 1000 Mbps, the connection fails or errors occur" on page 47
- "If your computer is a Gigabit Ethernet model, it cannot connect to the network at 1000 Mbps. Instead, it connects at 100 Mbps" on page 48

Your computer cannot connect to the network

Symptom: Your computer cannot connect to the network.

Actions: Ensure that:

- The cable is installed properly.

The network cable must be securely connected to both the Ethernet connector of your computer and the RJ45 connector of the hub. The maximum allowable distance from the computer to hub is 100 meters. If the cable is connected and the distance is within acceptable limits but the problem persists, try a different cable.

- The cable is installed properly.
- You are using the correct device driver.

  On the Windows 7 operating system, do the following:

  1. Click **Start → Control Panel**.
  2. Click **Hardware and Sound**.
  3. Click **Device Manager**. If you are prompted for an administrator password or confirmation, type the password or provide confirmation.
  4. If an exclamation mark is displayed next to an adapter name under **Network adapters**, you might not be using the correct driver or the driver is not enabled. To update the driver, right-click the highlighted adapter.
  5. Click **Update Driver Software**, and then follow the instructions on the screen.

  n the Windows 8 or Windows 8.1 operating system, do the following:

  1. Open Control Panel.
  2. Click **Hardware and Sound**.
  3. Click **Device Manager**. If you are prompted for an administrator password or confirmation, type the password or provide confirmation.
  4. If an exclamation mark is displayed next to an adapter name under **Network adapters**, you might not be using the correct driver or the driver is not enabled. To update the driver, right-click the highlighted adapter.
  5. Click **Update Driver Software**, and then follow the instructions on the screen.
- The switch port and the adapter have the same duplex setting.

  If you configured the adapter for full duplex, ensure that the switch port is also configured for full duplex. Setting the wrong duplex mode can degrade performance, cause data loss, or result in lost connections.
- You have installed all networking software that is necessary for your network environment.

  Check with your LAN administrator for the necessary networking software.

The adapter stops working for no apparent reason

Symptom: The adapter stops working for no apparent reason.

Action: The network driver files may be corrupt or missing. Update the driver by referring to the “Solution” description for the procedure to ensure that the correct device driver is installed.

The Wake on LAN feature is not working

Symptom: The Wake on LAN (WOL) feature is not working.

Actions:

- Ensure that WOL is enabled in the BIOS Setup Utility program.
- If it is, check with your LAN administrator for the necessary settings.

If your computer is a Gigabit Ethernet model and you use a speed of 1000 Mbps, the connection fails or errors occur

Symptom: If your computer is a Gigabit Ethernet model and you use a speed of 1000 Mbps, the connection fails or errors occur.

Actions:

- Use Category 5 wiring and ensure that the network cable is securely connected.
- Connect to a 1000 BASE-T hub/switch (not 1000 BASE-X).

If your computer is a Gigabit Ethernet model, it cannot connect to the network at 1000 Mbps. Instead, it connects at 100 Mbps

Symptom: If your computer is a Gigabit Ethernet model, it cannot connect to the network at 1000 Mbps. Instead, it connects at 100 Mbps.

Actions:

- Try another cable.
- Ensure that the link partner is set to auto-negotiate.
- Ensure that the switch is 802.3ab-compliant (gigabit over copper).

A wireless LAN problem

Symptom: You cannot connect using the built-in wireless networking card.

Actions:

- Ensure that your wireless LAN driver is the latest version. Check the Web site and verify the driver version supported by Access Connections is the latest documented in the readme file.
- Ensure that your computer is within range of a wireless access point.
- Ensure that the wireless radio is enabled by double-clicking the Access Connections icon in the Windows notification area.
- Check Network Name (SSID), and your encryption information. Use Access Connections to verify this case-sensitive information.

A wireless WAN problem

Message: Unauthorized WAN card is plugged in - Power off and remove the WAN card.

Action: The wide area network (WAN) card is not supported on this computer. Remove it.

Note: A wireless WAN card is supported only on some computer models.

Bluetooth problem

Symptom: Sound does not come from the Bluetooth headset or headphone but comes from the local speaker even though the headset or headphone is connected using the Headset profile or AV profile.

Action: Do the following:

1. Exit the application that uses the sound device (for example, Windows Media® Player).
2. Open Control Panel.
3. Click **Hardware and Sound → Sound**.
4. Select the **Playback** tab.
5. If you are using the Headset profile, select **Bluetooth Hands-free Audio** and click the **Set Default** button. If you are using the AV profile, select **Stereo Audio** and click the **Set Default** button.
6. Click **OK** to close the Sound window.

Note: Bluetooth is supported only on some computer models.

Option problems

Use this information to diagnose problems with Lenovo hardware options that do not have their own troubleshooting information.

Select your symptom from the following list:

- "An option that was just installed does not work" on page 49
- "An option that previously worked does not work now" on page 49

An option that was just installed does not work

Symptom: An option that was just installed does not work.

Action: Verify that:

- The option is designed for your computer.
- You followed the installation instructions supplied with the option and the installation instructions provided with your computer, and all option files (such as device drivers, if required) are installed correctly.
- You have not loosened other installed options or cables.
- If the option is an adapter, you have provided enough hardware resources for the adapter to function correctly. See the documentation supplied with the adapter (as well as the documentation for any other installed adapters) to determine the resources required for each adapter.

If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see "Lenovo Support Web site" on page 32.

An option that previously worked does not work now

Symptom: An option that previously worked does not work now.

Actions:

- Verify that all option hardware and cable connections are secure.
- If the option comes with its own test instructions, use those instructions to test the option.
- If the failing option is a SCSI option, verify that:
  - The cables for all external SCSI options are connected correctly.
  - The last option in each SCSI chain, or the end of the SCSI cable, is terminated correctly.
  - All external SCSI options are turned on. External SCSI options must be turned on before the computer is turned on. For more information, see your SCSI documentation.
- Verify that the option and any required device drivers are installed correctly.

If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see "Lenovo Support Web site" on page 32.

Performance and lockup problems

Poor performance and lockup problems can be a result of any of the following:

- "Insufficient free hard disk drive space" on page 50
- "Excessive number of fragmented files" on page 50

Make a selection from the above list to find out more about the corrective actions you can take.

Insufficient free hard disk drive space

Symptom: Insufficient free hard disk drive space

The Windows operating system will slow down and might produce errors if the hard disk drive gets too full.

To check the amount of free space on the Windows 7 operating system, do the following:

1. Click **Start** → **Computer**.
2. Right-click your C drive entry and then click **Properties**. The amount of free disk space is displayed.

To check the amount of free space on the Windows 8 operating system, do the following:

1. Open File Explorer and click **Computer**.
2. Right-click your C drive entry and then click **Properties**. The amount of free disk space is displayed.

To check the amount of free space on the Windows 8.1 operating system, do the following:

1. Open File Explorer.
2. Right-click your C drive entry and then click **Properties**. The amount of free disk space is displayed.

To free up disk space, do any of the following:

- Method 1
  1. On the Windows 7 operating system, click **Start** → **Computer**. On the Windows 8 operating system, open File Explorer and click **Computer**. On the Windows 8.1 operating system, open File Explorer.
  2. Right-click your C drive entry and then click **Properties**.
  3. Click **Disk Cleanup**.
  4. A list of unnecessary file categories is displayed. Select each file category you want to delete, and then click **OK**.
- Method 2
  1. Open Control Panel.
  2. Click **Programs**.
  3. Click **Turn Windows features on or off**.
  4. A list of optional Windows components is displayed. Follow the instructions on the screen.
- Method 3
  1. On the Windows 7 operating system, click **Start** → **Computer**. On the Windows 8 operating system, open File Explorer and click **Computer**. On the Windows 8.1 operating system, open File Explorer.
  2. Right-click your C drive entry and then click **Properties**.
  3. Click **Disk Cleanup**.
  4. Click **Clean up system files**.
  5. Click the **More Options** tab.
  6. In the **Programs and Features** area, click the **Clean up** button.
  7. A list of installed programs is displayed. Select the program that you want to remove. Click **Uninstall/Change** or **Uninstall**.
- Clean out your Inbox, Sent Items, and Deleted Items folders from your e-mail application. The folder names and procedures vary depending on your e-mail application. If you need assistance, see the help system for your e-mail application.

Excessive number of fragmented files

Symptom: Excessive number of fragmented files

Action: Run the Windows Disk Defragmenter program.

Note: Depending on the size of the hard disk drive and amount of data currently stored on the hard disk drive, the disk-defragmentation process might take up to several hours to complete.

On the Windows 7 operating system, do the following:

1. Close any programs that are currently running and close any open windows.
2. Click **Start** → **Computer**.
3. Right-click your C drive entry and then click **Properties**.
4. Click the **Tools** tab.
5. Click **Defragment Now**, then click **Continue**.
6. Click **Defragment Now** again to start a disk-defragmentation process.

On the Windows 8 or Windows 8.1 operating system, do the following:

1. Close any programs that are currently running and close any open windows.
2. On Windows 8, open File Explorer and click **Computer**. On Windows 8.1, open File Explorer.
3. Right-click your C drive entry and then click **Properties**.
4. Click the **Tools** tab and then click **Optimize**.
5. Click **Optimize** in the Optimize Drives window that is displayed to start a disk-defragmentation process.

Insufficient memory

Symptom: Insufficient memory

In general, the more memory that is installed, the better the Windows operating system runs.

Action: Install additional memory. For information about purchasing memory, see "Lenovo Support Web site" on page 32. For step-by-step instructions on installing memory, see "Installing or replacing a memory module" on page 91.

If these actions do not correct the problem, run the diagnostic programs (see "Lenovo Solution Center" on page 54 for instructions). If you need technical assistance, see "Lenovo Support Web site" on page 32.

Printer problems

Symptom: The printer does not work.

Actions: Verify that:

1. The printer is turned on and is online.
2. Paper is loaded correctly.
3. The printer signal cable is securely connected to the correct parallel, serial, or USB connector on the computer.

Note: Non-IEEE-approved printer signal cables might cause unpredictable problems.

1. Any device drivers and other software that came with the printer are correctly installed.
2. You have assigned the printer port correctly in your operating system, application program, or BIOS settings. For more information about BIOS settings, see Chapter 6 "Using the Setup Utility program" on page 55.

If the problem persists, run the tests described in the documentation that comes with your printer. If you cannot correct the problem, have the computer serviced. See "Lenovo Support Web site" on page 32.

Serial port problems

Use this information to troubleshoot the serial port and devices attached to the serial port.

Symptom: Serial port cannot be accessed.

Actions:

- Ensure that the serial cable is securely connected to the serial port on the computer and to the serial device. If the serial device has its own power cord, ensure that it is attached to a properly grounded electrical outlet.
- If the serial device has its own On/Off switch, ensure that it is in the On position.
- If the serial device has an Online switch, ensure that it is in the Online position.
- If the serial device is a printer, ensure that paper is loaded correctly.
- Verify that any software supplied with the serial device is correctly installed. Refer to the documentation for the serial-device option.
- Ensure that the serial-port adapter, if you added one, is properly installed and firmly seated.

If these actions do not correct the problem, run the Lenovo Solution Center program. If you need technical assistance, see “Lenovo Support Web site” on page 32.

Software problems

Select your symptom from the following list:

- “When using a sort feature, dates do not sort in the correct order” on page 52
- “Software does not work as expected” on page 52

When using a sort feature, dates do not sort in the correct order

Symptom: When using a sort feature, dates do not sort in the correct order.

Action: Some software developed before the year 2000 used only the last two digits of a year to sort dates, always assuming the first two digits were 19. Consequently, these programs sort dates out of order. Check with your software manufacturer to see if any updates are available. Many software manufacturers make updates available from the World Wide Web.

Software does not work as expected

Symptom: Software does not work as expected.

Actions:

- Most software programs have built-in help systems that provide instructions for most tasks. If you are having difficulty performing a specific task within a software program, refer to the help system for that program. Help systems are typically accessible from a menu or button in the program, and frequently from the F1 key.
- If you have difficulty with the Windows operating system or one of its components, refer to the Windows help system. It is accessible from the Windows **Start** menu.
- To determine if problems are caused by newly installed software, verify that:
  - Your computer has the minimum memory requirements needed to use the software. See the information supplied with the software to verify memory requirements. (If you just installed an adapter or memory, you might have a memory-address conflict.)
  - The software is designed to operate on your computer.

  - Other software works on your computer.
  - The software you are using works correctly on another computer.
- If you received any error messages while using the software program, see the printed documentation supplied with the software or the help system for that software for a description of the messages and solutions to the problem.
- Check with your software manufacturer to see if any updates are available. Many software manufacturers make updates available from the World Wide Web.
- If the software program used to work correctly, but does not work correctly now, do the following:
  - On the Windows 7 operating system, click **Start** → **Control Panel** → **System and Security** → **System** → **System Protection** → **System Restore**. Then, follow the instructions on the screen.
  - On the Windows 8 or Windows 8.1 operating system, open Control Panel and click **System and Security** → **System** → **System Protection** → **System Restore**. Then, follow the instructions on the screen.
- If you are unable to resolve the problem through other methods, uninstall the software program and reinstall it.

If these actions do not correct the problem, you might need technical assistance. Contact your software manufacturer or see "Lenovo Support Web site" on page 32 for details.

USB problems

Symptom: The USB connectors cannot be accessed.

Actions:

- Ensure that the USB cable is securely connected to the USB connector and to the USB device. If the USB device has its own power cord, ensure that it is attached to a properly grounded electrical outlet.
- If the USB device has its own On/Off switch, ensure that it is in the On position.
- If the USB device has an Online switch, ensure that it is in the Online position.
- If the USB device is a printer, ensure that paper is loaded correctly.
- Ensure that any device drivers or other software supplied with the USB device is correctly installed. Refer to the documentation for the USB device.
- Reset the device by detaching and reattaching the USB connector.

If these actions do not correct the problem, run the Lenovo Solution Center program to test the USB connector. If the USB device came with its own diagnostics, run those diagnostics against the USB device. If you need technical assistance, see "Lenovo Support Web site" on page 32.

Diagnostics

The diagnostic program is used to test hardware components of your computer. The diagnostic program can also report operating-system-controlled settings that interfere with the correct operation of your computer. You can use the preinstalled diagnostic program to diagnose computer problems, if your computer is running the Windows operating system.

Notes:

1. Your computer is preinstalled with the Lenovo Solution Center program for diagnostic purposes. For more information about the Lenovo Solution Center program, see "Lenovo Solution Center" on page 54.

2. If you are unable to isolate and repair the problem yourself after running the diagnostic program, save and print the log files created by the diagnostic program. You will need the log files when you speak to a Lenovo technical support representative.

Lenovo Solution Center

The Lenovo Solution Center program enables you to troubleshoot and resolve computer problems. It combines diagnostic tests, system information collection, security status, and support information, along with hints and tips for maximum system performance.

Notes:

- The Lenovo Solution Center program can be downloaded from http://www.lenovo.com/diags.
- If you are using a Windows operating system other than Windows 7, Windows 8, or Windows 8.1, go to http://www.lenovo.com/diags for the latest information on diagnostics for your computer.

To run the Lenovo Solution Center program, see "Lenovo programs" on page 30.

For additional information, refer to the Lenovo Solution Center help system.

Note: If you are unable to isolate and repair the problem yourself after running the program, save and print the log files. You will need the log files when you speak to a Lenovo technical support representative.

UEFI diagnostic program

A UEFI diagnostic program is preinstalled on the computer. It enables you to test memory modules and internal storage devices, view system information, and check and recover bad sectors on internal storage devices.

To run the UEFI diagnostic program, do the following:

1. Turn on the computer. If the computer cannot be turned on, go to "Basic troubleshooting" on page 35. If an error code is displayed, go to Chapter 8 "Symptom-to-FRU Index" on page 63 for error code descriptions and troubleshooting hints.
2. Repeatedly press and release the F10 key when turning on the computer. The main screen of the UEFI diagnostic program is displayed.
3. Follow the instructions on the screen to use the diagnostic program.

The options on the main screen are as follows:

Table 2. Items on the main screen of the UEFI diagnostic program

DIAGNOSTICS	TOOLS
• LCD test • Memory - Quick test • Memory - Extended test • Motherboard test • PCI-e test • Storage - Quick test	• System information • Recover bad sectors tool • Generate configuration file • Execute from configuration file • Exit application

Chapter 6. Using the Setup Utility program

The Setup Utility program is used to view and change the configuration settings of your computer, regardless of which operating system you are using. However, the operating system settings might override any similar settings in the Setup Utility program.

Starting the Setup Utility program

To start the Setup Utility program, do the following:

1. Ensure that your computer is turned off.
2. Repeatedly press and release the F1 key when turning on the computer. When you hear multiple beeps or see a logo screen, release the F1 key.

   Note: If a Power-On Password or an Administrator Password has been set, the Setup Utility program menu will not be displayed until you type the correct password. For more information, see "Using passwords" on page 55.

When the POST detects that the hard disk drive has been removed from your computer or the memory module size has decreased, an error message will be displayed when you start the computer and you will be prompted to do one of the following:

- Press F1 to enter the Setup Utility program.

  Note: After you enter the Setup Utility program, press F10 to save changes and exit the Setup Utility program. Press Enter when prompted to confirm the exit. The error message will not be displayed again.
- Press F2 to bypass the error message and log in to the operating system.

Note: You have to enable the configuration change detection feature for the POST to detect the removal of the hard disk drive. To enable the configuration change detection feature, do the following:

1. Start the Setup Utility program.
2. From the Setup Utility program main menu, select **Security → Configuration Change Detection**, and press Enter.
3. Select **Enabled** and press Enter.
4. Press F10 to save changes and exit the Setup Utility program. Press Enter when prompted to confirm the exit.

Viewing and changing settings

The Setup Utility program menu lists various items about the system configuration. To view or change settings, start the Setup Utility program. See "Starting the Setup Utility program" on page 55. Then, follow the instructions on the screen.

You can use either the keyboard or the mouse to navigate through BIOS menu choices. The keys used to perform various tasks are displayed at the bottom of each screen.

Using passwords

By using the Setup Utility program, you can set passwords to prevent unauthorized access to your computer and data. The following types of passwords are available:

- Power-On Password

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- Administrator Password
- Hard Disk Password

You do not have to set any passwords to use your computer. However, using passwords improves computing security. If you decide to set any passwords, read the following sections.

Password considerations

A password can be any combination of up to 64 alphabetic and numeric characters. For security reasons, it is recommended to use a strong password that cannot be easily compromised. To set a strong password, use the following guidelines:

- Have at least eight characters in length
- Contain at least one alphabetic character and one numeric character
- Setup Utility program and hard disk passwords are not case sensitive
- Not be your name or your user name
- Not be a common word or a common name
- Be significantly different from your previous passwords

Power-on password

When a power-on password is set, you are prompted to type a valid password each time the computer is turned on. The computer cannot be used until the valid password is typed in.

Administrator password

Setting an administrator password deters unauthorized users from changing configuration settings. If you are responsible for maintaining the configuration settings of several computers, you might want to set an Administrator Password.

When an administrator password is set, you are prompted to type a valid password each time you try to access the Setup Utility program. The Setup Utility program cannot be accessed until a valid password is typed in.

If both the power-on password and administrator password are set, you can type either password. However, you must use your administrator password to change any configuration settings.

Setting, changing, and deleting a password

To set, change, or delete a password, do the following:

1. Start the Setup Utility program. See “Starting the Setup Utility program” on page 55.
2. From the Setup Utility program main menu, select **Security**.
3. Depending on the password type, select **Set Power-On Password**, **Set Administrator Password**, or **Hard Disk Password**.
4. Follow the instructions on the right side of the screen to set, change, or delete a password.

   Note: A password can be any combination of up to 64 alphabetic and numeric characters. For more information, see “Password considerations” on page 56.

Erasing lost or forgotten passwords (clearing CMOS)

This section provides instructions on how to erase lost or forgotten passwords, such as a user password.

To erase a lost or forgotten password, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover.
3. Locate the Clear CMOS /Recovery jumper on the system board.
4. Move the jumper from the standard position (pin 1 and pin 2) to the maintenance position (pin 2 and pin 3).
5. Reinstall the computer cover and connect the power cord.
6. Turn on the computer and leave it on for approximately 10 seconds. Then, turn off the computer by holding the power switch for approximately five seconds.
7. Repeat step 1 through step 2.
8. Move the Clear CMOS /Recovery jumper back to the standard position (pin 1 and pin 2).
9. Reinstall the computer cover and connect the power cord.

Enabling or disabling a device

This section provides information on how to enable or disable user access to the following devices:

USB Setup	Use this option to enable or disable a USB connector. When a USB connector is disabled, the device connected to the USB connector cannot be used.
SATA Controller	When this feature is set to **Disable**, all devices connected to the SATA connectors (such as hard disk drives or the optical drive) are disabled and cannot be accessed.

To enable or disable a device, do the following:

1. Start the Setup Utility program. See "Starting the Setup Utility program" on page 55.
2. From the Setup Utility program main menu, select **Devices**.
3. Depending on the device you want to enable or disable, do one of the following:
   - Select **USB Setup** to enable or disable a USB device.
   - Select **ATA Drive Setup** to enable or disable a SATA device.
4. Select the desired settings and press Enter.
5. Press F10 to save changes and exit the Setup Utility program. See "Exiting the Setup Utility program" on page 60.

Selecting a startup device

If your computer does not start up from a device such as the disc or hard disk drive as expected, do one of the following to select the startup device you want.

Selecting a temporary startup device

Use this procedure to select a temporary startup device.

Note: Not all discs and hard disk drives are bootable.

1. Turn off your computer.
2. Repeatedly press and release the F12 key when turning on the computer. When the Please select boot device window displays, release the F12 key.
3. Select the desired startup device and press Enter. The computer will start up from the device you selected.

Note: Selecting a startup device from the Please select boot device window does not permanently change the startup sequence.

Selecting or changing the startup device sequence

To view or permanently change the configured startup device sequence, do the following:

1. Start the Setup Utility program. See "Starting the Setup Utility program" on page 55.
2. From the Setup Utility program main menu, select **Startup**.
3. Select the devices for the Primary Startup Sequence, the Automatic Startup Sequence, and the Error Startup Sequence. Read the information displayed on the right side of the screen.
4. Press F10 to save changes and exit the Setup Utility program. See "Exiting the Setup Utility program" on page 60.

Enabling ErP LPS compliance mode

Lenovo computers meet the eco-design requirements of the ErP Lot 3 regulation. For more information, go to:
http://www.lenovo.com/ecodeclaration

You can enable the energy-related products directive (ErP) lowest power state (LPS) compliance mode in the Setup Utility program to reduce the consumption of electricity when your computer is in sleep or off mode.

To enable ErP LPS compliance mode in the Setup Utility program, do the following:

1. Start the Setup Utility program. See "Starting the Setup Utility program" on page 55.
2. From the Setup Utility program main menu, select **Power** → **Enhanced Power Saving Mode**, and press Enter.
3. Select **Enabled** and press Enter.
4. From the **Power** menu, select **Automatic Power On** and press Enter.
5. Select **Wake on Lan** and press Enter.
6. Select **Disabled** and press Enter.
7. Press F10 to save changes and exit the Setup Utility program. Press Enter when prompted to confirm the exit.

Note: When ErP LPS compliance mode is enabled, you can wake up your computer by doing one of the following:

- Pressing the power button
- Enabling the wake up on alarm feature

  The wake up on alarm feature enables your computer to wake up at a set time. To enable the wake up on alarm feature, do the following:

  1. Start the Setup Utility program.
  2. From the Setup Utility program main menu, select **Power** → **Automatic Power On**, and press Enter.
  3. Select **Wake Up on Alarm** and press Enter. Then follow the instructions on the screen.
  4. Press F10 to save changes and exit the Setup Utility program. Press Enter when prompted to confirm the exit.

- Enabling the after power loss feature

  The after power loss feature enables your computer to wake up when the power supply resumes after a sudden loss of electricity. To enable the after power loss feature, do the following:

  1. Start the Setup Utility program.

2. From the Setup Utility program main menu, select **Power → After Power Loss**, and press Enter.
3. Select **Power On** and press Enter.
4. Press F10 to save changes and exit the Setup Utility program. Press Enter when prompted to confirm the exit.

ICE performance mode

You can adjust the acoustic and thermal performance of your computer through the **ICE Performance Mode** menu. Two choices are available:

- **Better Acoustic Performance** (default setting)
- **Better Thermal Performance**

By enabling **Better Acoustic Performance**, your computer will run with less noise at a normal thermal level. By enabling **Better Thermal Performance**, your computer will run at a better thermal level with normal acoustic performance.

To configure the ICE performance mode, do the following:

1. Start the Setup Utility program. See "Starting the Setup Utility program" on page 55.
2. From the Setup Utility program main menu, select **Power**.
3. Select **Intelligent Cooling Engine (ICE)**. The Intelligent Cooling Engine (ICE) window is displayed.
4. Select **ICE Performance Mode**. The ICE Performance Mode window is displayed.
5. Select **Better Acoustic Performance** or **Better Thermal Performance** as desired.
6. Press F10 to save changes and exit the Setup Utility program. See "Exiting the Setup Utility program" on page 60.

ICE thermal alert

You can monitor the thermal function of your computer under critical thermal situations through the **ICE Thermal Alert** menu. Two choices are available:

- **Enabled** (default setting)
- **Disabled**

After enabling the ICE thermal alert function, when critical thermal situations occur, such as malfunctioning fans, abnormally high temperature, and poor cooling performances, an alert log will be written into the Windows system log. The alert log can help you identify the thermal problems.

To configure the ICE thermal alert function, do the following:

1. Start the Setup Utility program. See "Starting the Setup Utility program" on page 55.
2. From the Setup Utility program main menu, select **Power**.
3. Select **Intelligent Cooling Engine (ICE)**. The Intelligent Cooling Engine (ICE) window is displayed.
4. Select **ICE Thermal Alert**. The ICE Thermal Alert window is displayed.
5. Select **Enabled** or **Disabled** as desired.
6. Press F10 to save changes and exit the Setup Utility program. See "Exiting the Setup Utility program" on page 60.

Changing the BIOS settings before installing a new operating system

BIOS settings vary by operating system. Change the BIOS settings before installing a new operating system.

To change the BIOS settings, do the following:

1. Start the Setup Utility program. See "Starting the Setup Utility program" on page 55.
2. From the Setup Utility program main menu, select **Exit → OS Optimized Default**.
3. Depending on the operating system to be installed, do one of the following:
   - To install the Windows 8 (64-bit) or Windows 8.1 (64-bit) operating system, select **Enabled**.
   - To install an operating system other than Windows 8 (64-bit) or Windows 8.1 (64-bit), select **Disabled**.
4. Select **Yes** in the window displayed and press Enter to confirm your selection.
5. Press F10 to save changes and exit the Setup Utility program. See "Exiting the Setup Utility program" on page 60.

Exiting the Setup Utility program

After you finish viewing or changing settings, press Esc to return to the Setup Utility program main menu. You might have to press Esc several times. Do one of the following:

- If you want to save the new settings, press F10 to save changes and exit the Setup Utility program.
- If you do not want to save the settings, select **Exit → Discard Changes and Exit**, and then press Enter. When the Reset Without Saving window shows, select **Yes**, and then press Enter to exit the Setup Utility program.
- If you want to return to the default settings, press F9 to load the default settings, and then press F10 to save and exit the Setup Utility program.

Chapter 7. Configuring RAID

This chapter provides instructions about how toconfigure Redundant Array of Independent Disks (RAID) for your computer.

Note: The information about configuring RAID in this chapter is applicable only for a Windows environment. For information about configuring RAID in a Linux® environment, contact your Linux software provider.

RAID Level

Your computer must have the minimum number of SATA hard disk drives installed for the supported level of RAID below:

- RAID Level 0 – Striped disk array
  - Two hard disk drives minimum
  - Better performance without fault tolerance
- RAID Level 1 – Mirrored disk array
  - Two hard disk drives minimum
  - Improved read performance and 100% redundancy

Configuring the system BIOS to enable SATA RAID functionality

This section describes how to configure the system BIOS to enable SATA RAID functionality.

Note: Use the arrow keys on the keyboard to make selections.

To enable SATA RAID functionality, do the following:

1. Start the Setup Utility program. See "Starting the Setup Utility program" on page 55.
2. Select **Devices → ATA Drive Setup**.
3. Select **Configure SATA as** and press Enter.
4. Select **RAID Mode** and press Enter.
5. Press F10 to save the new settings and exit the Setup Utility program.

Creating RAID volumes

This section describes how to use the Intel® Matrix Storage Manager option ROM configuration utility to create RAID volumes.

To create RAID volumes, do the following:

1. Press Ctrl+I when prompted to enter the Intel Matrix Storage Manager option ROM configuration utility during the computer startup.
2. Use the up and down arrow keys to select **Create RAID Volume** and press Enter.
3. Type a proper RAID Volume name in the **Name** field and press Tab.
4. Use the arrow keys to select a RAID level in the **RAID Level** field and press Tab.
5. If appropriate, use the arrow keys to select a Stripe Size in the **Stripe Size** field and press Tab.
6. Type a volume size in the **Capacity** field and press Tab.
7. Press Enter to initiate volume creation.

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8. When prompted, press Y to accept the warning message and create the volume.
9. Return to step 2 to create additional RAID volumes, or select **Exit** and press Enter.
10. Press Y when prompted to confirm the exit.

Deleting RAID volumes

This section describes how to use the Intel Matrix Storage Manager option ROM configuration utility to delete RAID volumes.

To delete RAID volumes, do the following:

1. Press Ctrl+I when prompted to enter the Intel Matrix Storage Manager option ROM configuration utility during the computer startup.
2. Use the up and down arrow keys to select **Delete RAID Volume** and press Enter.
3. Use the arrow keys to select the RAID volume to be deleted and press Delete.
4. When prompted, press Y to confirm the deletion of the selected RAID volume. Deleting a RAID volume will reset the hard disk drives to non-RAID.
5. After deleting a RAID volume, you can:
   - Return to step 2 to delete additional RAID volumes.
   - See "Creating RAID volumes" on page 61 for RAID volume creation.
   - Use the up and down arrow keys to select **Exit** and press Enter.

Resetting disks to non-RAID

This section describes how to reset your hard disk drives to non-RAID.

To reset your hard disk drives to non-RAID, do the following:

1. Press Ctrl+I when prompted to enter the Intel Matrix Storage Manager option ROM configuration utility during the computer startup.
2. Use the up and down arrow keys to select **Reset Disks to Non-RAID** and press Enter.
3. Use the arrow keys and the space key to mark individual physical hard disk drives to be reset, and then press Enter to complete the selection.
4. When prompted, press Y to confirm the reset action.
5. After completing the Reset Disks to Non-RAID function, you can:
   - See "Deleting RAID volumes" on page 62 for RAID volume deletion.
   - See "Creating RAID volumes" on page 61 for RAID volume creation.
   - Use the up and down arrow keys to select **Exit** and press Enter.

Chapter 8. Symptom-to-FRU Index

The Symptom-to-FRU index lists error symptoms and possible causes. The most likely cause is listed first. Always begin with Chapter 4 “General checkout” on page 33. This index can also be used to help you decide which FRUs to have available when servicing a computer. If you are unable to correct the problem using this index, go to “Undetermined problems” on page 67.

Notes:

- If you have both an error message and an incorrect audio response, diagnose the error message first.
- If you cannot run the diagnostic tests or you get a diagnostic error code when running a test, but did receive a POST error message, diagnose the POST error message first.
- If you did not receive any error message, look for a description of your error symptoms in the first part of this index.

Hard disk drive boot error

A hard disk drive boot error can have the following causes.

Error	FRU/Action
The start-up drive is not in the boot sequence in configuration.	Check the configuration and ensure the start-up drive is in the boot sequence.
No operating system installed on the boot drive.	Install an operating system on the boot drive.
The boot sector on the startup drive is corrupted.	The drive must be formatted. Do the following: 1. Attempt to back up the data on the failing hard disk drive. 2. Using the operating system programs, format the hard disk drive.
The drive is defective.	Replace the hard disk drive.

Power supply problems

If you suspect a power problem, use the following procedures.

Check/Verify	FRU/Action
Check the following for proper installation. • Power cord • On/Off switch connector • On/Off switch power supply connector • System board power supply connectors • Microprocessor(s) connection	Reseat connectors
Check the power cord for continuity.	Power cord
Check the power-on switch for continuity.	Power-on switch

Beep symptoms

Beep symptoms are tones or a series of tones separated by pauses (intervals without sound) during POST.

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The following table describes the beep symptoms.

Beep symptom	FRU/Action
2 short beeps CMOS setting error	Perform the following actions in order. 1. Start the Setup Utility program and press F10 to Save and exit. See Chapter 6 "Using the Setup Utility program" on page 55. 2. Start the Setup Utility program and press F9 to load defaults and then press F10 to Save and exit. 3. Perform a Boot-block recovery. See "Recovering from a POST/BIOS update failure" on page 221.
3 short and 1 long beeps DRAM memory error	Perform the following actions in order. 1. Ensure that the memory module(s) are properly seated in the connector(s). 2. Replace the memory module(s). 3. Replace the system board.

POST error codes

Each time you power-on the system, it performs a series of tests that check the operation of the system and some options. This series of tests is called the *Power-On Self-Test*, or *POST*. POST does the following operations.

- Checks some basic system-board operations
- Checks the memory operation
- Starts the video operation
- Verifies that the boot drive is working

If the POST detects a problem, an error message appears on the screen. A single problem can cause several error messages to appear. When you correct the cause of the first error message, the other error messages probably will not appear on the screen the next time you turn on the system.

POST Error code	POST Error message	Description/Action
00CE	Machine Type or Serial Number is INVALID	This error message is displayed when the machine type or the serial number is invalid.
0211	Keyboard not found	This error message is displayed when there is no keyboard detected.
0135	Fan failure	The system might be overheating. Press F1 to enter the Setup Utility program. Then press F10 to save and exit the Setup Utility program. **Note:** If the problem is caused by the microprocessor fan, pressing F10 will not solve the problem.
0164	Memory size decreased	This error message is displayed when the memory size has decreased. Press F1 to enter the Setup Utility program. Then press F10 to save and exit the Setup Utility program.

POST Error code	POST Error message	Description/Action
1762	SATA device configuration change has occurred	This error message is displayed when a hard disk drive or optical drive change has been made. Press F1 to enter the Setup Utility program. Then press F10 to save and exit the Setup Utility program.
1820	More than one external fingerprint reader is attached. Power off and remove all but the reader that you set up within your main operating system.	If more than one external fingerprint reader is connected to a computer, this error message will be displayed to inform you to remove all of the fingerprint keyboards except the one compatible with the fingerprint application on your computer.
1962	No operating system found. Press any key to repeat boot sequence.	This error occurs only after the POST is completed. Press any key to repeat boot sequence.
0162	Setup data integrity check failure	Press F1 to enter the Setup Utility program. Then press F10 to save and exit the Setup Utility program.
0167	No processor microcode update found	This error message indicates that there is no microcode update image for the current microprocessor.
0175	System Security - Security data corrupted	Press F1 to enter the Setup Utility program. Then press F10 to save and exit the Setup Utility program.
0176	System Security - The system has been tampered with	This error message is displayed when the computer is turned on with the cover open or removed. Press F1 to enter the Setup Utility program. Then press F10 to save and exit the Setup Utility program.
0189	System Security - Can not read the Security EEPROM	This error message indicates that the Security EEPROM may be broken or removed. Press F1 to enter the Setup Utility program. Then press F10 to save and exit the Setup Utility program.
0197	System Security - Unauthorized security data change detected	Press F1 to enter the Setup Utility program. Then press F10 to save and exit the Setup Utility program.
0190	System Security - Invalid security change requested	Press F1 to enter the Setup Utility program. Then press F10 to save and exit the Setup Utility program.
0199	System Security - Security password retry count exceeded	Press F1 to enter the Setup Utility program. Then press F10 to save and exit the Setup Utility program.

Miscellaneous error conditions

Message/Symptom	**FRU/Action**
Changing display colors	**Display/Monitor**
Computer will *not* power-off. See "Hard disk drive boot error" on page 63.	1. Power Switch 2. System Board 3. Riser card, if installed.
Computer will *not* RPL from server	1. Ensure that network is in startup sequence as first device or first device after diskette. 2. Ensure that network adapter is enabled for RPL. 3. Network adapter (Advise network administrator of new MAC address)
Computer will *not* perform a Wake On LAN® (if applicable)	1. Check power supply and signal cable connections to network adapter. 2. Ensure that the operating system settings are set to enable Wake on LAN. 3. Ensure Wake On LAN feature is enabled in Setup/Configuration (see "Starting the Setup Utility program" on page 55) 4. Ensure network administrator is using correct MAC address. 5. Ensure no interrupt or I/O address conflicts. 6. Network adapter (advise network administrator of new MAC address)
Dead computer. See "Hard disk drive boot error" on page 63.	1. Power Supply 2. System Board
Diskette drive in-use light remains on or does not light when drive is active.	1. Diskette Drive 2. System Board 3. Diskette Drive Cable
Blank screen except for flashing cursor.	1. System Board 2. Primary Hard Disk Drive 3. Hard Disk Drive Cable
Incorrect memory size during POST	1. Run the Memory tests. 2. Memory Module 3. System Board
"Insert a Diskette" icon appears with a known-good diagnostics diskette in the first 3.5-inch diskette drive.	1. System Board 2. Diskette Drive Cable 3. Network Adapter
Intensity or color varies from left to right of characters and color bars	1. Display 2. Video adapter (if present) 3. System Board
No power or fan not running	1. See "Hard disk drive boot error" on page 63. 2. Replace system board

Message/Symptom	FRU/Action
Non-system disk or disk error-type message with a known-good diagnostic diskette.	1. Diskette Drive 2. System Board 3. Diskette Drive Cable
Other display symptoms not listed above (including blank or illegible display)	1. Display 2. System Board
Power-on indicator or hard disk drive in-use light not on, but computer works correctly	1. Power switch/LED assembly 2. System Board
Printer problems	1. Printer 2. System Board
Program loads from the hard disk with a known-good diagnostics diskette in the first 3.5-inch diskette drive	1. Run the Setup Utility program and check Startup sequence. 2. Diskette Drive 3. Diskette Drive Cable 4. System Board 5. Power Supply
RPL computer cannot access programs from its own hard disk.	1. If network administrator is using LCCM Hybrid RPL, check startup sequence: a. **First device - network** b. **Second device - hard disk** 2. Hard disk drive
RPL computer does not RPL from server	1. Check startup sequence. 2. Check the network adapter LED status.
Serial or parallel port device failure (system board port)	1. External Device Self-Test OK? 2. External Device 3. Cable 4. System Board
Serial or parallel port device failure (adapter port)	1. External Device Self-Test OK? 2. External Device 3. Cable 4. Alternate Adapter 5. System Board
Some or all keys on the keyboard do not work	1. Keyboard 2. Keyboard Cable 3. System Board

Undetermined problems

This section provides instructions on how to find out the failing devices or adapters.

1. Power-off the computer.
2. Remove or disconnect the following components (if installed) one at a time.
    a. External devices (modem, printer, or mouse)
    b. Any adapters
    c. Memory modules

   d. Extended video memory
   e. External Cache
   f. External Cache RAM
   g. Hard disk drive
   h. Diskette drive
3. Power-on the computer to re-test the system.
4. Repeat steps 1 through 3 until you find the failing device or adapter.

If all devices and adapters have been removed, and the problem continues, replace the system board.

Chapter 9. Locations

This chapter introduces the locations of the computer hardware components.

For machine types: 30A0 and 30A1

This section describes the locations for computer types 30A0 and 30A1.

Locating connectors, controls, and indicators on the front of your computer

Figure 1 “Front connector, control, and indicator locations” on page 69 shows the locations of the connectors, controls, and indicators on the front of your computer.

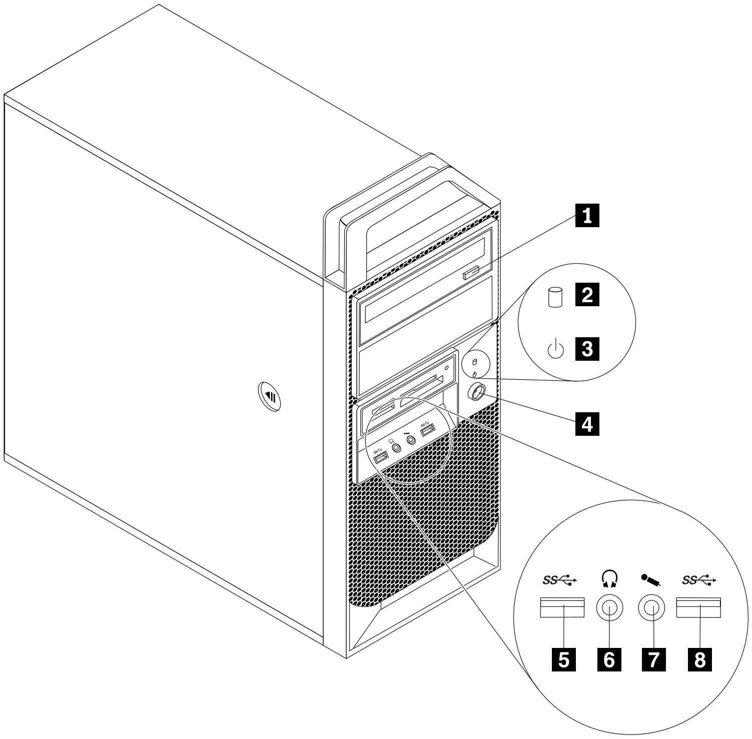

Figure 1. Front connector, control, and indicator locations

1 Optical drive eject/close button	**2** Hard disk drive activity indicator
3 Power indicator	**4** Power switch
5 USB 3.0 connector (USB port 1)	**6** Headphone connector
7 Microphone connector	**8** USB 3.0 connector (USB port 2)

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Locating connectors on the rear of your computer

Figure 2 "Rear connector locations" on page 70 shows the locations of the connectors on the rear of your computer. Some connectors on the rear of your computer are color-coded to help you determine where to connect the cables on your computer.

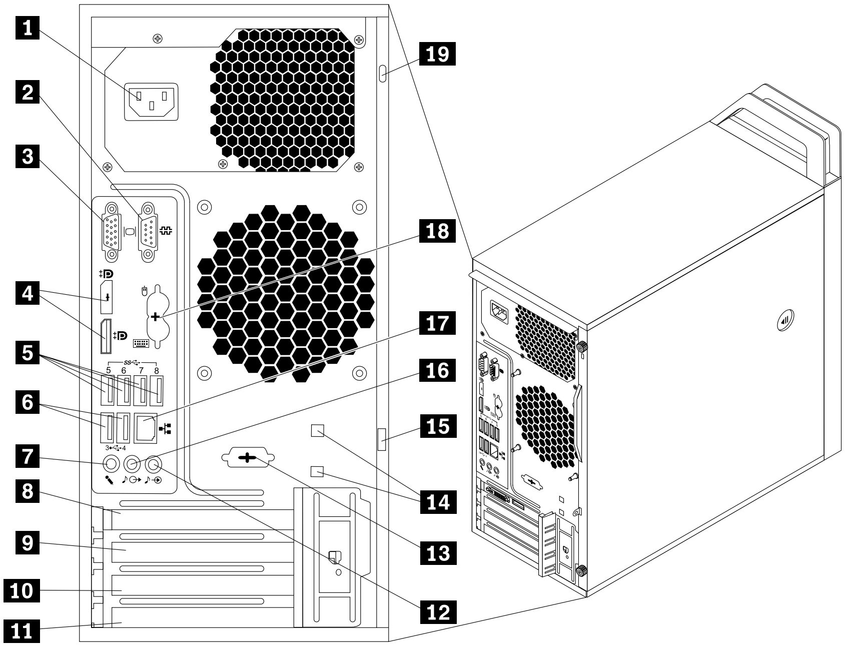

Figure 2. Rear connector locations

1 Power cord connector	**2** Serial port (Serial port 1)
3 VGA monitor connector	**4** DisplayPort® connectors (2)
5 USB 3.0 connectors (USB ports 5 to 8)	**6** USB 2.0 connectors (USB ports 3 and 4)
7 Microphone connector	**8** PCI Express x16 graphics card slot (graphics card available in some models)
9 PCI Express x1 card slot	**10** PCI Express x16 card slot (negotiable link width x4, x1)
11 PCI card slot	**12** Audio line-in connector
13 Optional serial port (Serial port 2)	**14** Cable-lock slots (2)
15 Padlock loop	**16** Audio line-out connector
17 Ethernet connector	**18** PS/2 keyboard and mouse connectors (optional)
19 Security-lock slot	

Connector	Description
Audio line-in connector	Used to receive audio signals from an external audio device, such as a stereo system. When you attach an external audio device, a cable is connected between the audio line-out connector of the device and the audio line-in connector of the computer.
Audio line-out connector	Used to send audio signals from the computer to external devices, such as powered stereo speakers (speakers with built-in amplifiers), headphones, multimedia keyboards, or the audio line-in connector on a stereo system or other external recording device.

Connector	Description
DisplayPort connector	Used to attach a high-performance monitor, a direct-drive monitor, or other devices that use a DisplayPort connector. **Note:** The DisplayPort connector is not applicable on some models. If your computer has a graphics card installed, be sure to use a monitor connector on the graphics card.
Ethernet connector	Used to attach an Ethernet cable for a local area network (LAN). **Note:** To operate the computer within FCC Class B limits, use a Category 5 Ethernet cable.
Microphone connector	Used to attach a microphone to your computer when you want to record sound or if you use speech-recognition software.
PS/2 keyboard connector (optional)	Used to attach a keyboard that uses a PS/2 keyboard connector.
PS/2 mouse connector (optional)	Used to attach a mouse, a trackball, or other pointing devices that use a PS/2 mouse connector.
Serial port	Used to attach an external modem, a serial printer, or other devices that use a 9-pin serial port.
USB 2.0 connector	Used to attach a device that requires a USB 2.0 connector, such as a USB keyboard, a USB mouse, a USB scanner or a USB printer. If you have more than eight USB devices, you can purchase a USB hub, which you can use to connect additional USB devices.
USB 3.0 connector	Used to attach a device that requires a USB 2.0 or 3.0 connector, such as a USB keyboard, a USB mouse, a USB scanner or a USB printer. If you have more than eight USB devices, you can purchase a USB hub, which you can use to connect additional USB devices.
VGA monitor connector	Used to attach a VGA monitor or other devices that use a VGA monitor connector. **Note:** The VGA monitor connector is not applicable on some models. If your computer has a graphics card installed, be sure to use a monitor connector on the graphics card.

Locating major FRUs and CRUs

Figure 3 “Locating major FRUs and CRUs” on page 72 shows the locations of the major FRUs and CRUs in the computer. To remove the computer cover, see “Removing the computer cover” on page 86.

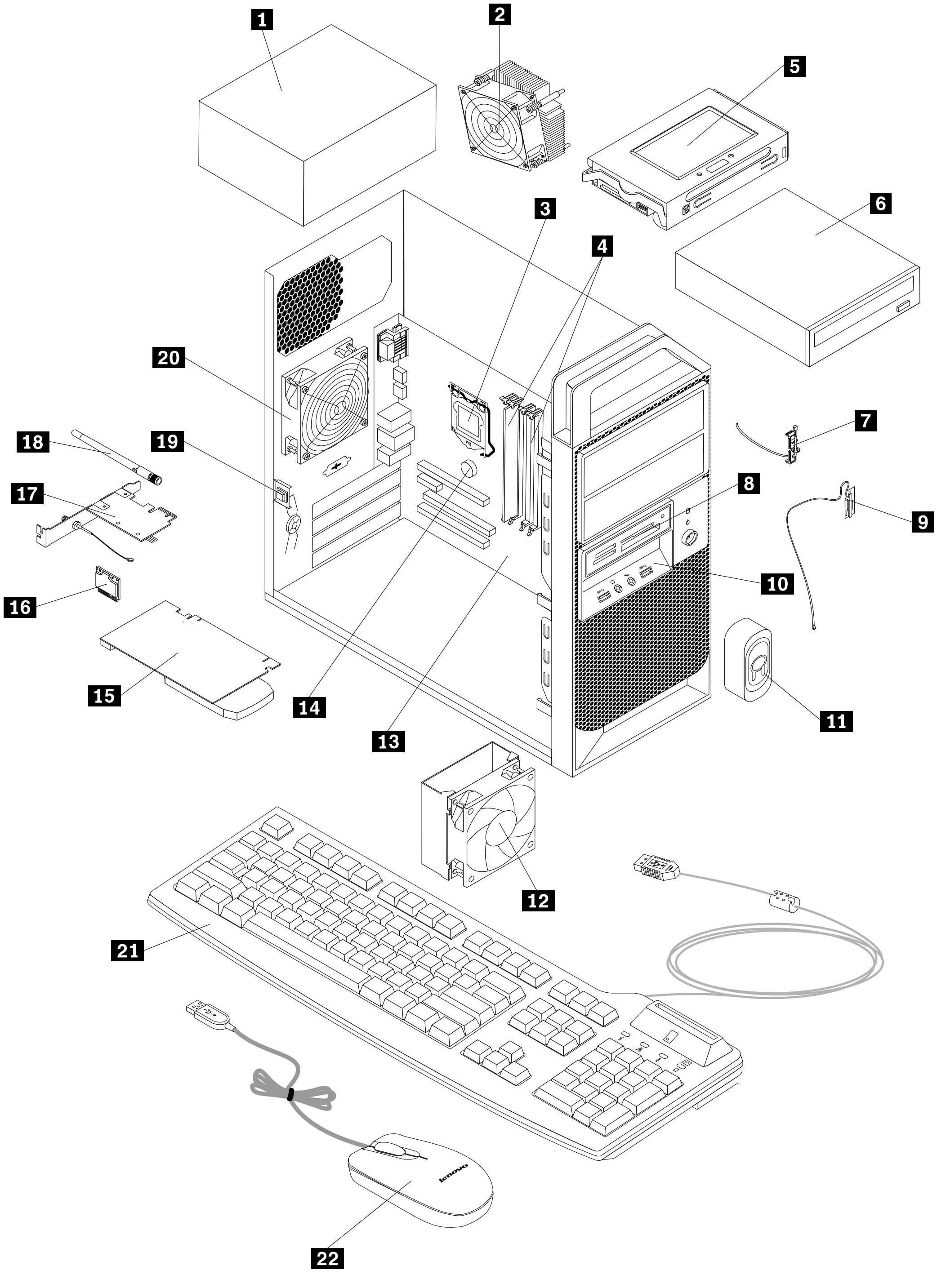

Figure 3. Locating major FRUs and CRUs

The following table lists the major FRUs shown in Figure 3 "Locating major FRUs and CRUs" on page 72 and identifies which FRUs also are self-service CRUs or optional-service CRUs.

Notes:

- Self-service CRUs: These CRUs unplug or are secured by no more than two screws. Examples of these types of CRUs include the keyboard, the mouse, any USB device, and the power cord. Other self-service CRUs depending on product design might include memory modules, adapter cards, hard disk drives, and optical drives.

- Optional-service CRUs: These CRUs are isolated parts within the computer and are concealed by an access panel that is typically secured by more than two screws. Once the access panel is removed, the specific CRU is visible.

Number	FRU description	Self-service CRU	Optional-service CRU
1	Power supply assembly	No	Yes
2	Heat sink and fan assembly	No	Yes
3	Microprocessor	No	Yes
4	Memory modules	Yes	No
5	Hard disk drive	Yes	No
6	Optical drive (available in some models)	Yes	No
7	Thermal sensor	Yes	No
8	Card reader (available in some models)	No	Yes
9	Front Wi-Fi antenna (available in some models)	No	Yes
10	Front audio and USB assembly	No	Yes
11	Internal speaker	Yes	No
12	Front fan assembly	No	Yes
13	System board	No	No
14	Battery	Yes	No
15	PCI card (available in some models)	Yes	No
16	Wi-Fi card module (available in some models)	No	Yes
17	Wi-Fi adapter card (available in some models)	No	Yes
18	Rear Wi-Fi antenna (available in some models)	Yes	No
19	Cover presence switch (also called intrusion switch)	Yes	No
20	Rear fan assembly	No	Yes
21	Keyboard	Yes	No
22	Mouse	Yes	No

Looking up FRU information

For detailed FRU information, such as the FRU part numbers and supported computer models, go to: http:/www.lenovo.com/serviceparts-lookup

Locating parts on the system board

Figure 4 “System board part locations” on page 74 shows the locations of the parts on the system board.

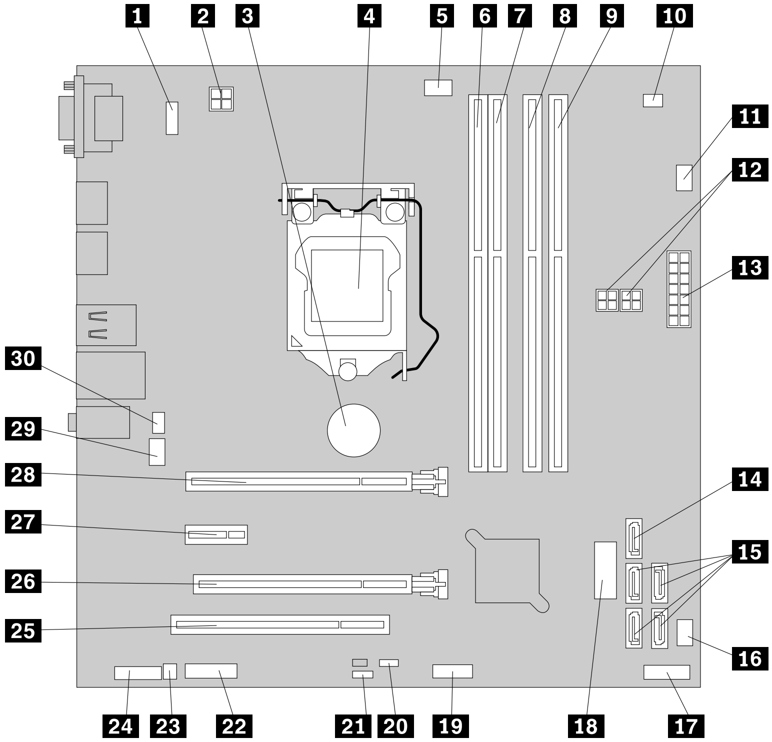
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Figure 4. System board part locations

1 PS/2 keyboard and mouse connector	**2** 4-pin power connector
3 Battery	**4** Microprocessor
5 Microprocessor fan connector	**6** Memory slot 1 (DIMM1)
7 Memory slot 2 (DIMM2)	**8** Memory slot 3 (DIMM3)
9 Memory slot 4 (DIMM4)	**10** Thermal sensor connector
11 Hard disk drive fan connector	**12** 4-pin power connectors (2)
13 14-pin power connector	**14** eSATA connector
15 SATA connectors 1 to 4 (SATA 3.0 connector)	**16** Power fan connector
17 Front panel connector (for connecting LED indicators and the power switch)	**18** Front USB 3.0 connector (for connecting USB connectors 1 and 2 on the front bezel)
19 Front USB 2.0 connector (for connecting an additional USB device)	**20** USB hardware disable header
21 Clear CMOS (Complementary Metal Oxide Semiconductor) /Recovery jumper	**22** Serial (COM2) connector
23 Internal speaker connector	**24** Front audio connector
25 PCI card slot	**26** PCI Express x16 card slot (negotiable link width x4, x1)
27 PCI Express x1 card slot	**28** PCI Express x16 graphics card slot (graphics card available in some models)
29 System fan connector	**30** Cover presence switch connector (Intrusion switch connector)

Locating internal drives

Internal drives are devices that your computer uses to read and store data. You can add drives to your computer to increase storage capacity and enable your computer to read other types of media. Internal drives are installed in bays.

When installing or replacing an internal drive, it is important to note the type and size of the drive that you can install or replace in each bay and correctly connect the cables to the drive installed. Refer to the appropriate section in “Installing or replacing hardware” on page 85 for instructions on how to install or replace internal drives for your computer.

Figure 5 “Drive bay locations” on page 76 shows the locations of the drive bays.

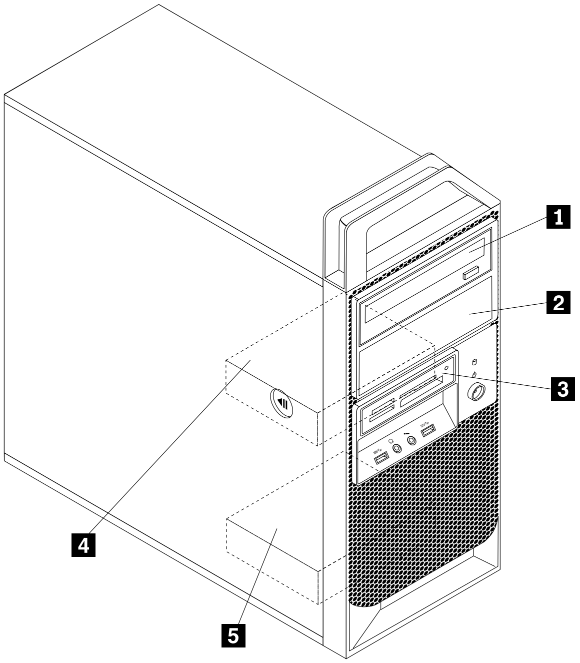

Figure 5. Drive bay locations

1	Bay 1 - Optical drive bay (with an optical drive installed on some models)
2	Bay 2 - Optical drive bay
3	Bay 3 - Card reader drive bay
4	Bay 4 - Primary SATA hard disk drive bay (with a 3.5-inch SATA hard disk drive installed)
5	Bay 5 - Secondary SATA hard disk drive bay

For machine types: 30A2 and 30A3

This section describes the locations for computer types 30A2 and 30A3.

Locating connectors, controls, and indicators on the front of your computer

Figure 6 “Front connector, control, and indicator locations” on page 77 shows the locations of the connectors, controls, and indicators on the front of your computer.

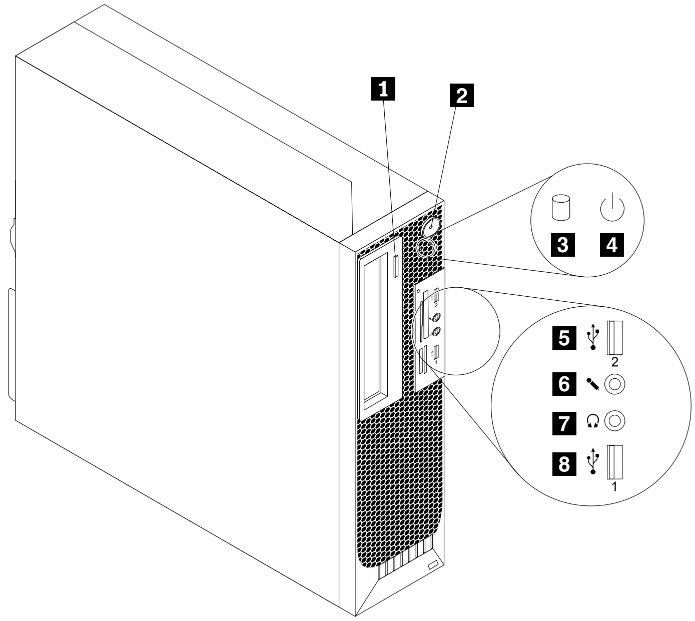

Figure 6. Front connector, control, and indicator locations

1 Optical drive eject/close button	**2** Power switch
3 Hard disk drive activity indicator	**4** Power indicator
5 USB 3.0 connector (USB port 2)	**6** Microphone connector
7 Headphone connector	**8** USB 3.0 connector (USB port 1)

Locating connectors on the rear of your computer

Figure 7 “Rear connector locations” on page 78 shows the locations of the connectors on the rear of your computer. Some connectors on the rear of your computer are color-coded to help you determine where to connect the cables on your computer.

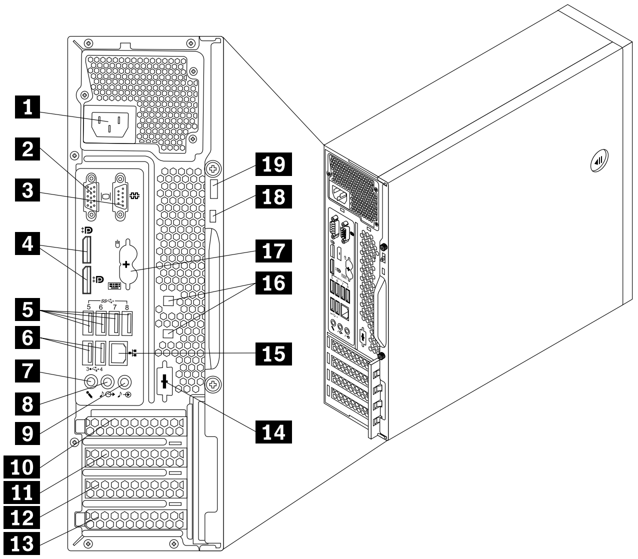

Figure 7. Rear connector locations

1 Power cord connector	**2** VGA monitor connector
3 Serial port (Serial port 1)	**4** DisplayPort connectors (2)
5 USB 3.0 connectors (USB ports 5 to 8)	**6** USB 2.0 connectors (USB ports 3 and 4)
7 Microphone connector	**8** Audio line-out connector
9 Audio line-in connector	**10** PCI Express x16 graphics card slot (graphics card available in some models)
11 PCI Express x1 card slot	**12** PCI Express x16 card slot (negotiable link width x4, x1)
13 PCI card slot	**14** Optional serial port (Serial port 2)
15 Ethernet connector	**16** Cable-lock slots (2)
17 PS/2 keyboard and mouse connectors (optional)	**18** Security-lock slot
19 Padlock loop	

Connector	**Description**
Audio line-in connector	Used to receive audio signals from an external audio device, such as a stereo system. When you attach an external audio device, a cable is connected between the audio line-out connector of the device and the audio line-in connector of the computer.
Audio line-out connector	Used to send audio signals from the computer to external devices, such as powered stereo speakers (speakers with built-in amplifiers), headphones, multimedia keyboards, or the audio line-in connector on a stereo system or other external recording device.

Connector	Description
DisplayPort connector	Used to attach a high-performance monitor, a direct-drive monitor, or other devices that use a DisplayPort connector. **Note:** The DisplayPort connector is not applicable on some models. If your computer has a graphics card installed, be sure to use a monitor connector on the graphics card.
Ethernet connector	Used to attach an Ethernet cable for a local area network (LAN). **Note:** To operate the computer within FCC Class B limits, use a Category 5 Ethernet cable.
Microphone connector	Used to attach a microphone to your computer when you want to record sound or if you use speech-recognition software.
PS/2 keyboard connector (optional)	Used to attach a keyboard that uses a PS/2 keyboard connector.
PS/2 mouse connector (optional)	Used to attach a mouse, a trackball, or other pointing devices that use a PS/2 mouse connector.
Serial port	Used to attach an external modem, a serial printer, or other devices that use a 9-pin serial port.
USB 2.0 connector	Used to attach a device that requires a USB 2.0 connector, such as a USB keyboard, a USB mouse, a USB scanner or a USB printer. If you have more than eight USB devices, you can purchase a USB hub, which you can use to connect additional USB devices.
USB 3.0 connector	Used to attach a device that requires a USB 2.0 or 3.0 connector, such as a USB keyboard, a USB mouse, a USB scanner or a USB printer. If you have more than eight USB devices, you can purchase a USB hub, which you can use to connect additional USB devices.
VGA monitor connector	Used to attach a VGA monitor or other devices that use a VGA monitor connector. **Note:** The VGA monitor connector is not applicable on some models. If your computer has a graphics card installed, be sure to use a monitor connector on the graphics card.

Locating major FRUs and CRUs

Figure 8 “Locating major FRUs and CRUs” on page 80 shows the locations of the major FRUs and CRUs in the computer. To open the computer cover, see “Removing the computer cover” on page 150.

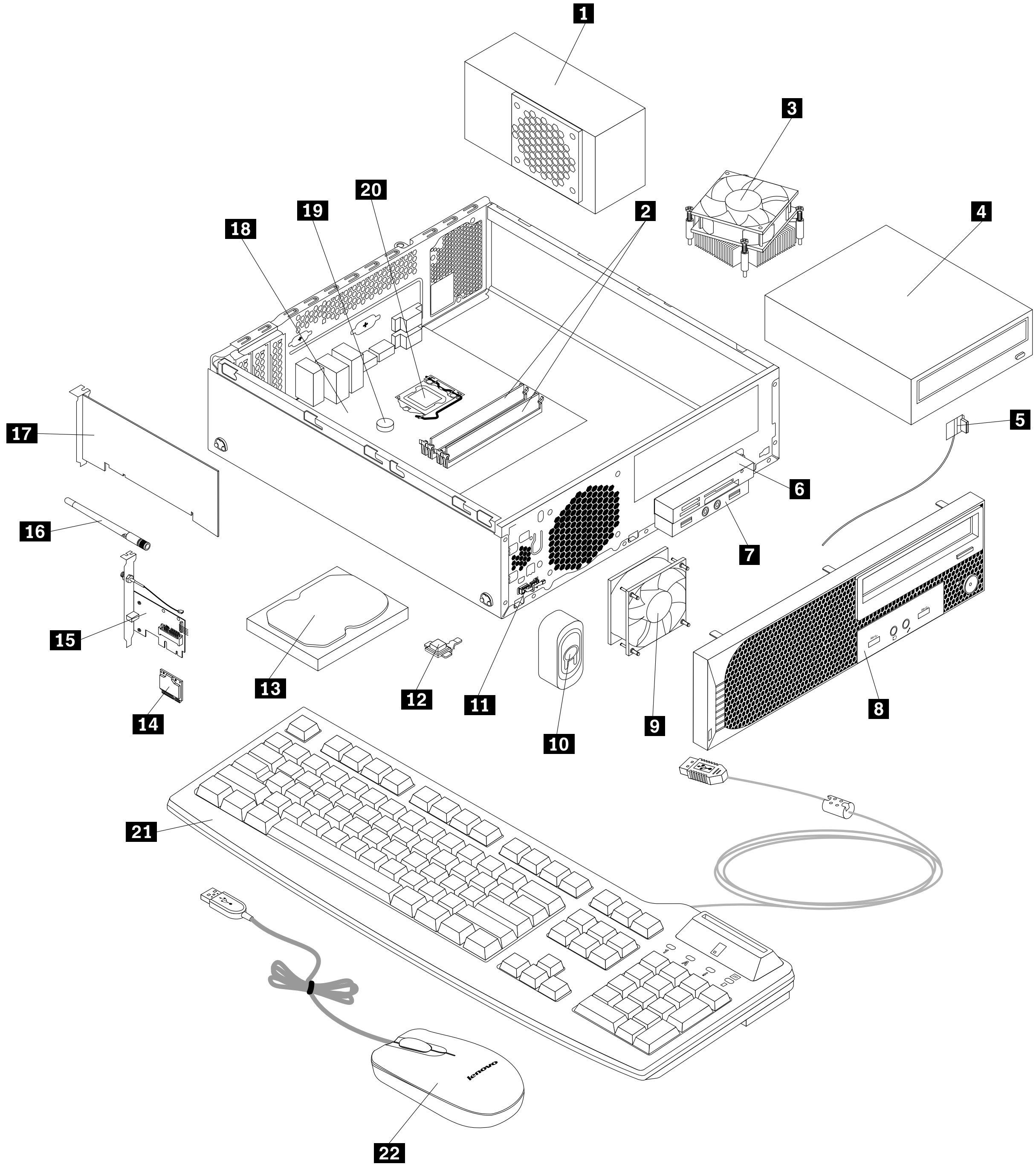

Figure 8. Locating major FRUs and CRUs

The following table lists the major FRUs shown in Figure 8 "Locating major FRUs and CRUs" on page 80 and identifies which FRUs also are self-service CRUs or optional-service CRUs.

Notes:

- Self-service CRUs: These CRUs unplug or are secured by no more than two screws. Examples of these types of CRUs include the keyboard, the mouse, any USB device, and the power cord. Other self-service CRUs depending on product design might include memory modules, adapter cards, hard disk drives, and optical drives.

- Optional-service CRUs: These CRUs are isolated parts within the computer and are concealed by an access panel that is typically secured by more than two screws. Once the access panel is removed, the specific CRU is visible.

Number	FRU description	Self-service CRU	Optional-service CRU
1	Power supply assembly	No	Yes
2	Memory module	Yes	No
3	Heat sink and fan assembly	No	Yes
4	Optical drive (available in some models)	Yes	No
5	Front Wi-Fi antenna (available in some models)	No	Yes
6	Card reader (available in some models)	No	Yes
7	Front audio and USB assembly	No	Yes
8	Front bezel	Yes	No
9	System fan	No	Yes
10	Internal speaker	No	Yes
11	Thermal sensor	Yes	No
12	Cover presence switch (also called intrusion switch, available in some models)	Yes	No
13	Hard disk drive or solid-state drive	Yes	No
14	Wi-Fi card module (available in some models)	No	Yes
15	Wi-Fi adapter card (available in some models)	No	Yes
16	Rear Wi-Fi antenna (available in some models)	Yes	No
17	PCI card (available in some models)	Yes	No
18	System board	No	No
19	Battery	Yes	No
20	Microprocessor	No	Yes
21	Keyboard	Yes	No
22	Mouse	Yes	No

Looking up FRU information

For detailed FRU information, such as the FRU part numbers and supported computer models, go to: http:/www.lenovo.com/serviceparts-lookup

Locating parts on the system board

Figure 9 “System board part locations” on page 82 shows the locations of the parts on the system board.

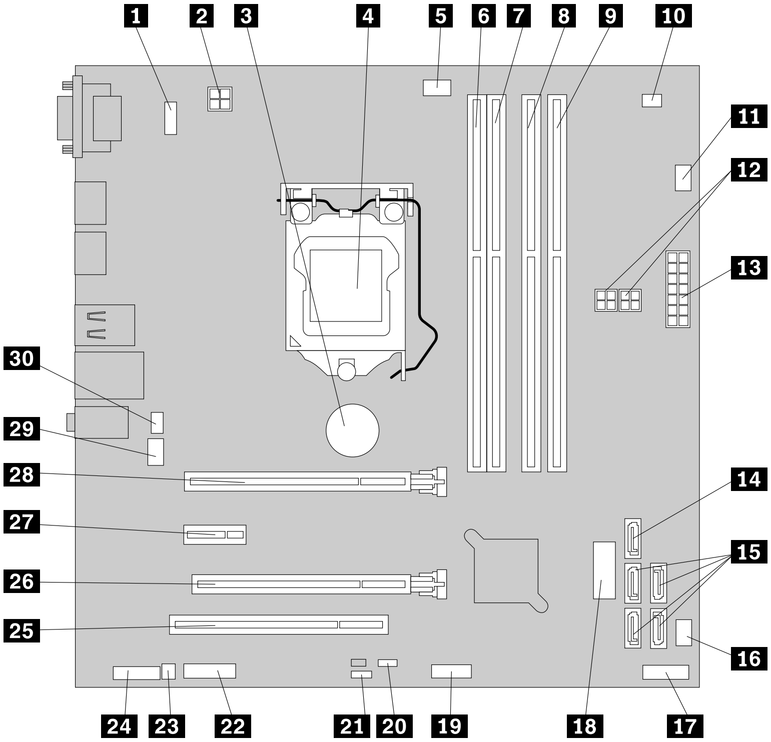
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Figure 9. System board part locations

1 PS/2 keyboard and mouse connector	**2** 4-pin power connector
3 Battery	**4** Microprocessor
5 Microprocessor fan connector	**6** Memory slot 1 (DIMM1)
7 Memory slot 2 (DIMM2)	**8** Memory slot 3 (DIMM3)
9 Memory slot 4 (DIMM4)	**10** Thermal sensor connector
11 Hard disk drive fan connector	**12** 4-pin power connectors (2)
13 14-pin power connector	**14** eSATA connector
15 SATA connectors 1 to 4 (SATA 3.0 connector)	**16** Power fan connector
17 Front panel connector (for connecting LED indicators and the power switch)	**18** Front USB 3.0 connector (for connecting USB connectors 1 and 2 on the front bezel)
19 Front USB 2.0 connector (for connecting an additional USB device)	**20** USB hardware disable header
21 Clear CMOS (Complementary Metal Oxide Semiconductor) /Recovery jumper	**22** Serial (COM2) connector
23 Internal speaker connector	**24** Front audio connector
25 PCI card slot	**26** PCI Express x16 card slot (negotiable link width x4, x1)
27 PCI Express x1 card slot	**28** PCI Express x16 graphics card slot (graphics card available in some models)
29 System fan connector	**30** Cover presence switch connector (Intrusion switch connector)

Locating internal drives

Internal drives are devices that your computer uses to read and store data. You can add drives to your computer to increase storage capacity and enable your computer to read other types of media. Internal drives are installed in bays.

When installing or replacing an internal drive, it is important to note the type and size of the drive that you can install or replace in each bay and correctly connect the cables to the drive installed. Refer to the appropriate section in "Installing or replacing hardware" on page 149 for instructions on how to install or replace internal drives for your computer.

Figure 10 "Drive bay locations" on page 84 shows the locations of the drive bays.

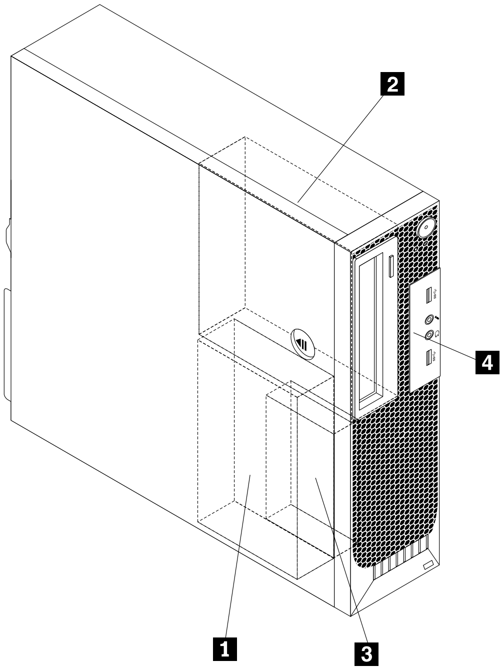

Figure 10. Drive bay locations

1	Bay 1 - Primary SATA hard disk drive bay (with a 3.5-inch hard disk drive or a 2.5-inch solid-state disk installed)
2	Bay 2 - Optical drive bay (with an optical drive installed)
3	Bay 3 - Secondary SATA hard disk drive bay (with a 2.5-inch hard disk drive or a 2.5-inch solid-state disk installed)
4	Bay 4 - Card reader drive bay

Chapter 10. Replacing FRUs (machine types: 30A0 and 30A1)

This chapter provides information about the FRU replacement instructions. Not all FRUs are documented.

Important: Ensure that you read and understand Chapter 2 "Safety information" on page 3 before replacing any FRU. These precautions and guidelines will help you work safely.

Note: FRU replacements are to be done only by trained service technicians.

Handling static-sensitive devices

Do not open the static-protective package containing the new part until the defective part has been removed from the computer and you are ready to install the new part. Static electricity, although harmless to you, can seriously damage computer components and parts.

When you handle parts and other computer components, take these precautions to avoid static-electricity damage:

- Limit your movement. Movement can cause static electricity to build up around you.
- Always handle parts and other computer components carefully. Handle PCI cards, memory modules, system boards, and microprocessors by the edges. Never touch any exposed circuitry.
- Prevent others from touching the parts and other computer components.
- Before you replace a new part, touch the static-protective package containing the part to a metal expansion-slot cover or other unpainted metal surface on the computer for at least two seconds. This reduces static electricity in the package and your body.
- When possible, remove the new part from the static-protective packaging, and install it directly in the computer without setting the part down. When this is not possible, place the static-protective package that the part came in on a smooth, level surface and place the part on it.
- Do not place the part on the computer cover or other metal surface.

Installing or replacing hardware

This section provides instructions on how to install or replace hardware for your computer. You can expand the capabilities of your computer and maintain your computer by installing or replacing hardware.

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

Notes:

1. Use only computer parts provided by Lenovo.
2. When installing or replacing an option, use the appropriate instructions in this section along with the instructions that come with the option.

Installing external options

You can connect external options to your computer, such as external speakers, a printer, or a scanner. For some external options, you must install additional software in addition to making the physical connection. When installing an external option, see "Locating connectors, controls, and indicators on the front of your computer" on page 69 and "Locating connectors on the rear of your computer" on page 70 to identify the

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required connector. Then, use the instructions that come with the option to help you make the connection and install any software or device drivers that are required for the option.

Removing the computer cover

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to remove the computer cover.

CAUTION:

Before you open the computer cover, turn off the computer and wait several minutes until the computer is cool.

To remove the computer cover, do the following:

1. Remove any media from the drives and turn off all attached devices and the computer.
2. Disconnect all power cords from electrical outlets.
3. Disconnect the power cords, Input/Output cables, and any other cables that are connected to the computer. See “Locating connectors, controls, and indicators on the front of your computer” on page 69 and “Locating connectors on the rear of your computer” on page 70.
4. Remove any locking device that secures the computer cover, such as a padlock or a Kensington-style cable lock.
5. Remove any screws that secure the computer cover.

6. Press the cover-release button on the side of the computer and slide the cover to the rear of the computer to remove the cover.

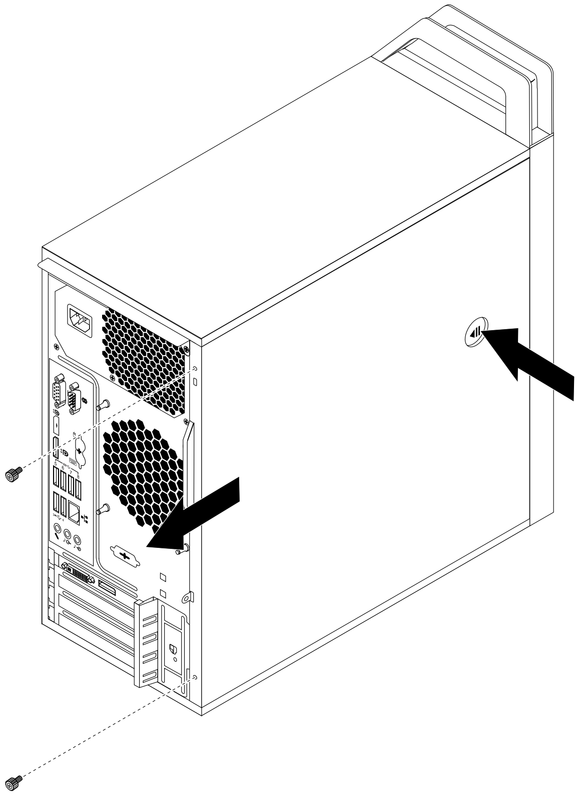


Figure 11. Removing the computer cover

Removing and reinstalling the front bezel

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to remove and reinstall the front bezel.

To remove and reinstall the front bezel, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 86.

3. Remove the front bezel by releasing the three plastic tabs on the left side and

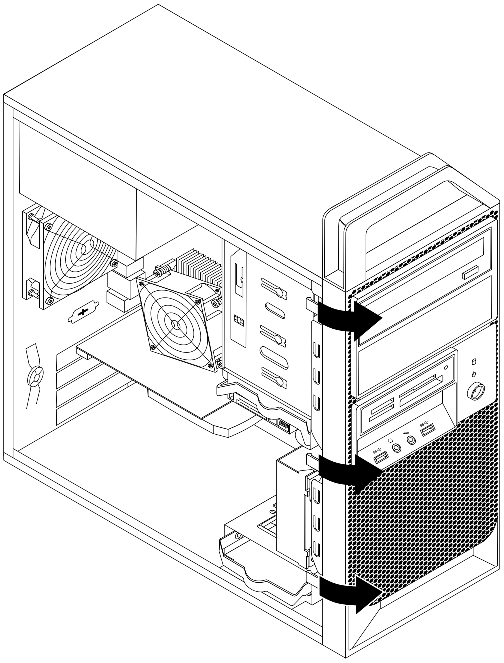


Figure 12. Removing the front bezel

4. To reinstall the front bezel, align the three plastic tabs on the right side of the front bezel with the corresponding holes in the chassis, then pivot the front bezel inwards until it snaps into position on the left side.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 147.

Installing or replacing a PCI card

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to install or replace a Peripheral Component Interconnect (PCI) card. Your computer has one PCI card slot, one PCI Express x1 card slot, one PCI Express x16 graphics card slot, and one PCI Express x16 card slot (negotiable link width x4, x1).

To install or replace a PCI card, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 86.

3. At the rear of the computer, press the release button **1** to open the card latch **2**.

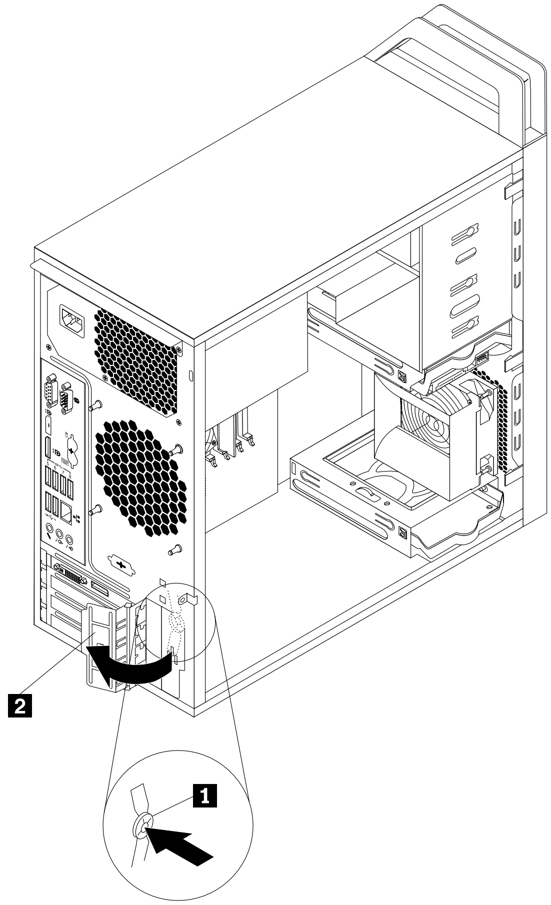


Figure 13. Opening the PCI card latch

4. Depending on whether you are installing or replacing a PCI card, do one of the following:
   - If you are installing a PCI card, remove the appropriate metal slot cover.
   - If you are replacing an old PCI card, grasp the old card that is currently installed and gently pull it out of the slot.

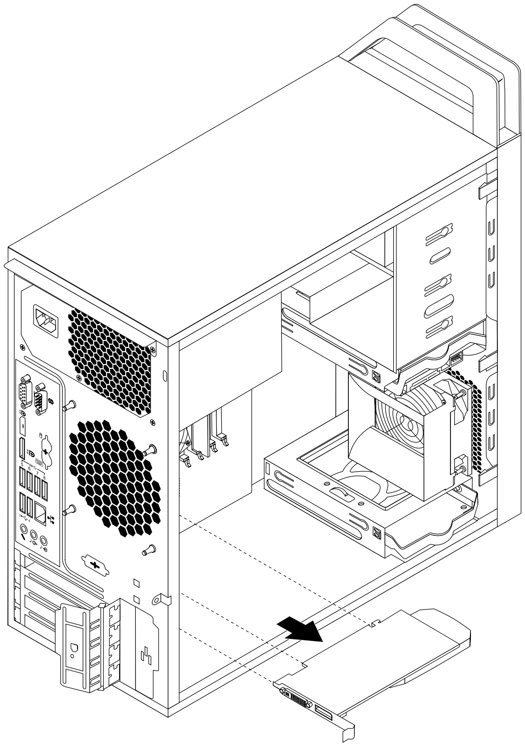


Figure 14. Removing a PCI card

Notes:

a. The card fits tightly into the card slot. If necessary, alternate moving each side of the card a small amount until it is removed from the card slot.

b. If the card is held in place by a retaining latch, disengage the card retaining latch on the PCI card slot. Then grasp the card and gently pull it out of the slot.

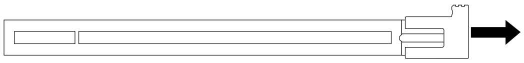


Figure 15. Disengaging the card retaining latch

5. Remove the new PCI card from its static-protective package.
6. Install the new card into the appropriate slot on the system board. See "Locating parts on the system board" on page 74.

   Note: If you are installing a PCI Express x16 graphics card, ensure that the memory slot retaining clips are closed before you install the graphics card.

7. Pivot the card latch to the closed position to secure the PCI card.

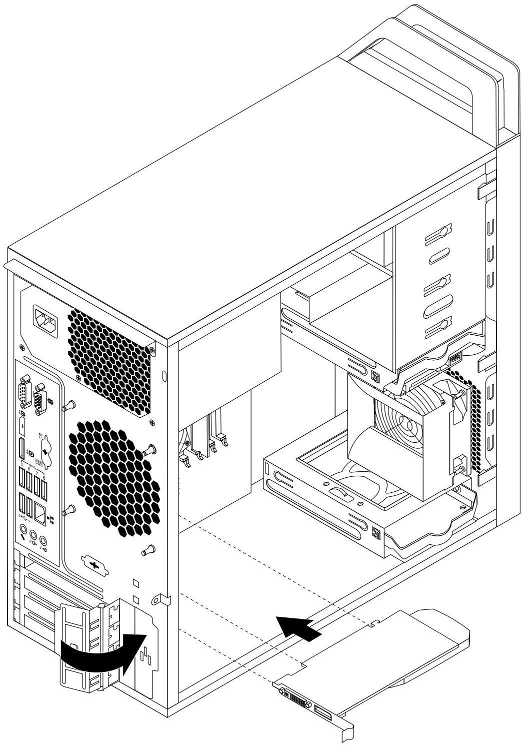


Figure 16. Installing a PCI card

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 147.

Installing or replacing a memory module

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to install or replace a memory module.

Your computer has four slots for installing or replacing double data rate 3 dual inline memory modules (DDR3 UDIMMs). that provide up to a maximum of 32 GB system memory. When installing or replacing a memory module, use 2 GB, 4 GB, or 8 GB DDR3 UDIMMs in any combination up to a maximum of 32 GB.

The following table provides information about the memory module installation rules that you should consider when installing or removing a memory module. The "X" mark indicates the memory slot(s) into which the memory module(s) should be installed in different situations. The numbers 1, 2, 3, and 4 indicate the installation sequence. To locate the memory module slots, see "Locating parts on the system board" on page 74.

UDIMM	DIMM 1	DIMM 2	DIMM 3	DIMM 4
One UDIMM		X		
Two UDIMMs		X, 1		X, 2
Three UDIMMs	X, 3	X, 1		X, 2
Four UDIMMs	X, 3	X, 1	X, 4	X, 2

To install or replace a memory module, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 86.
3. Lay the computer on its side for easier access to the system board.
4. Locate the memory slots. See "Locating parts on the system board" on page 74.
5. Remove any parts that might prevent your access to the memory slots. Depending on your computer model, you might need to remove the PCI Express x16 graphics card for easier access to the memory slots. See "Installing or replacing a PCI card" on page 88.
6. Depending on whether you are installing or replacing a memory module, do one of the following:
    - If you are replacing an old memory module, open the retaining clips and gently pull the memory module out of the memory slot.

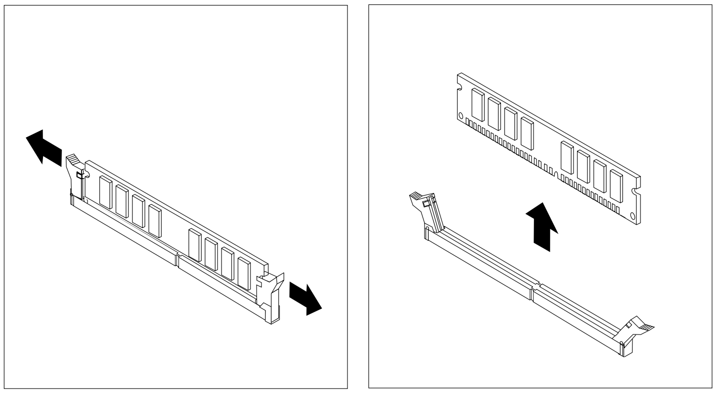


Figure 17. Removing a memory module

- If you are installing a memory module, open the retaining clips of the memory slot into which you want to install the memory module.

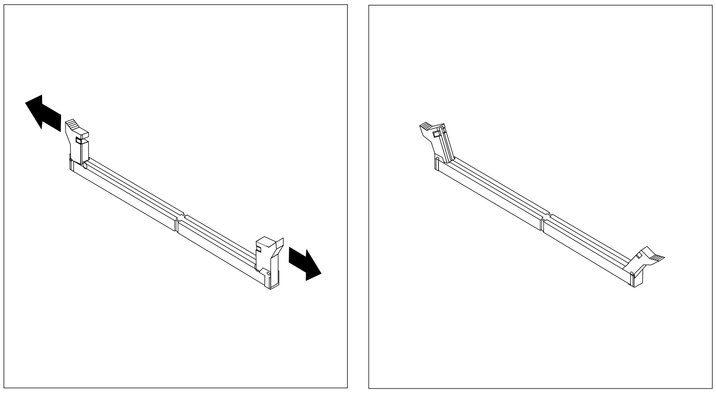


Figure 18. Opening the retaining clips

7. Position the new memory module over the memory slot. Ensure that the notch **1** on the memory module aligns correctly with the slot key **2** on the system board. Push the memory module straight down into the slot until the retaining clips close.

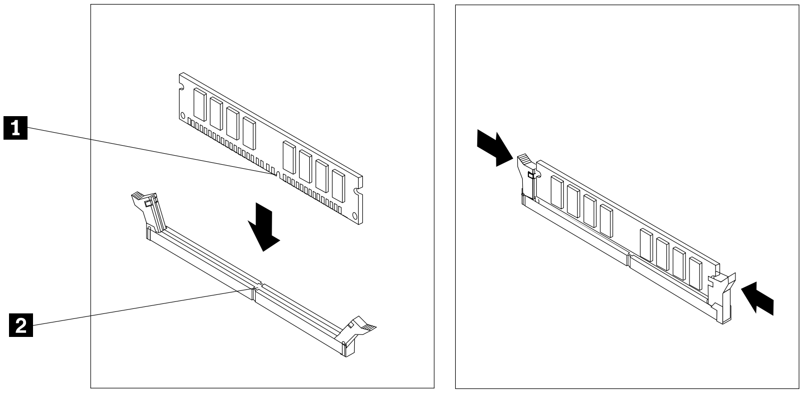


Figure 19. Installing a memory module

8. Reinstall the PCI Express x16 graphics card if you have removed it.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 147.

Installing or replacing the optical drive

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to install or replace the optical drive.

To install or replace an optical drive, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 86.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 87.
4. Depending on whether you are installing or replacing an optical drive, do one of the following:
   - If you are installing a secondary optical drive, remove the plastic panel in the front bezel for the drive bay you want to use. If there is a metal static shield installed in the drive bay, remove the metal static shield.
   - If you are replacing an optical drive, disconnect the signal cable and the power cable from the rear of the optical drive, press the blue release button, and then slide the optical drive out of the front of the computer.

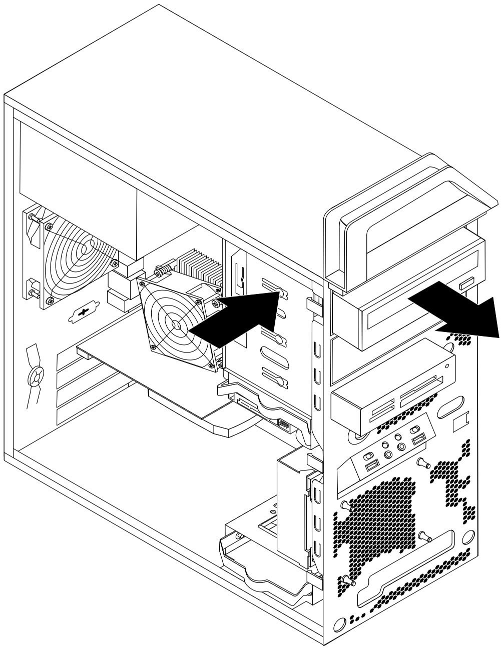


Figure 20. Removing the optical drive

5. Install the optical drive retainer on the side of the new optical drive.

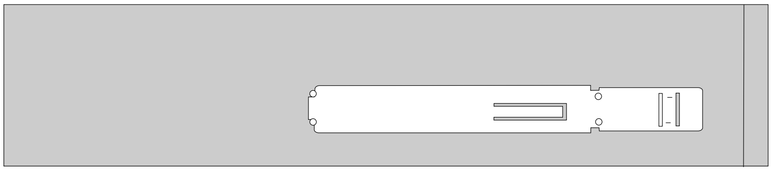


Figure 21. Installing the optical drive retainer

6. Slide the new optical drive into the drive bay from the front of the computer until the optical drive snaps into position.

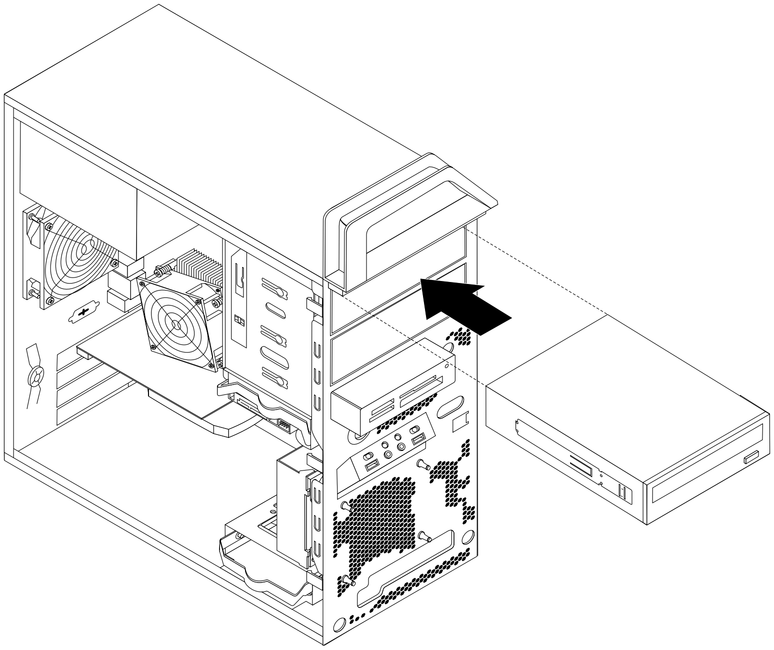


Figure 22. Installing the optical drive

7. Connect the signal cable and the power cable to the new optical drive.

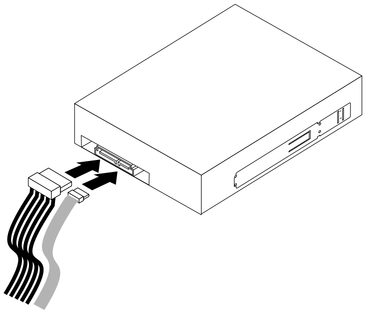


Figure 23. Connecting the optical drive

8. Reinstall the front bezel. See “Removing and reinstalling the front bezel” on page 87.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 147.

Installing or replacing the card reader

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to install or replace the card reader.

Note: The card reader is only available in some models. For new installation, see "Installing the card reader" on page 96. For replacement, see "Replacing the card reader" on page 98.

Installing the card reader

To install the card reader, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See "Removing the computer cover" on page 86.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 87.
4. Locate the card reader drive bay. See "Locating internal drives" on page 76.
5. Carefully pivot the card reader retainer as shown to remove it from the chassis.

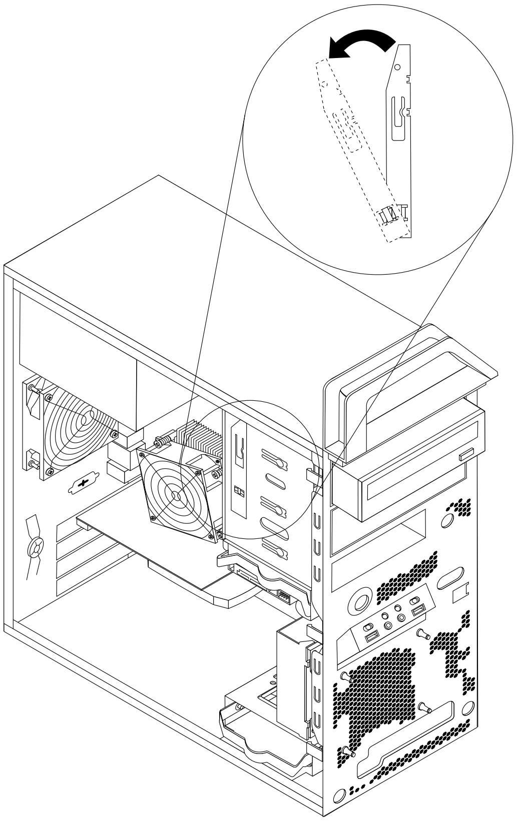


Figure 24. Removing the card reader retainer

6. Install the card reader retainer on the side of the new card reader.

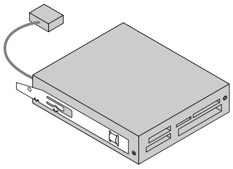


Figure 25. Installing the card reader retainer

7. Slide the new card reader with retainer into the card reader drive bay until it snaps into position.

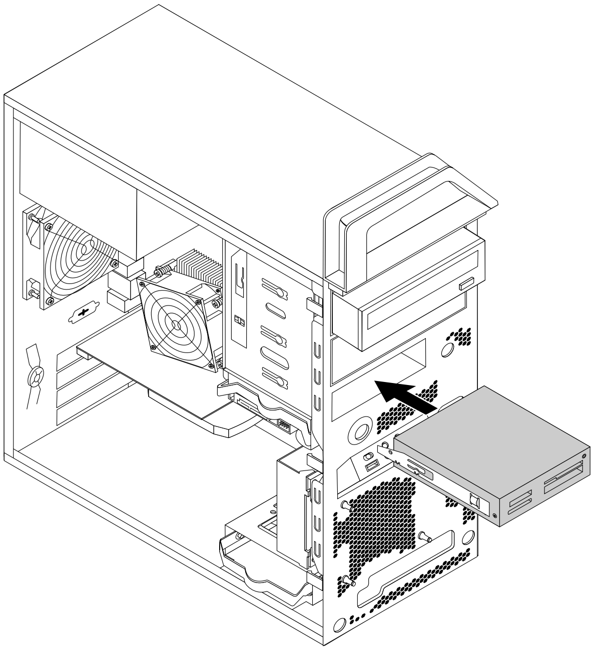


Figure 26. Installing the card reader

8. Connect the card reader cable to the front USB connector 2 on the system board. See "Locating parts on the system board" on page 74.
9. Locate the protective cover for the card reader drive bay on the front bezel. Remove the protective cover by pressing the small tab **1** to the left and then pulling the tab to completely disengage the cover from the front bezel.

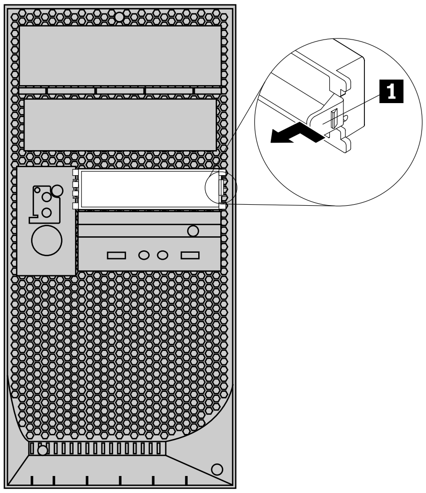


Figure 27. Removing the card reader cover

10. Reinstall the front bezel. See "Removing and reinstalling the front bezel" on page 87.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 147.

Replacing the card reader

To replace the card reader, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See “Removing the computer cover” on page 86.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 87.
4. Locate the card reader drive bay. See “Locating internal drives” on page 76.
5. Disconnect the card reader cable from the front USB connector 2 on the system board. See “Locating parts on the system board” on page 74.
6. Press the blue retaining clip and slide the card reader out of the chassis.

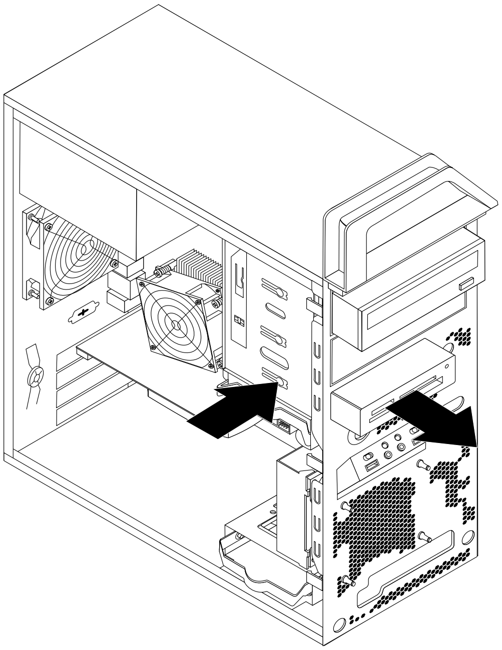


Figure 28. Removing the card reader

7. Install the card reader retainer on the side of the new card reader.

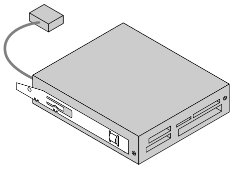


Figure 29. Installing the card reader retainer

8. Slide the new card reader with retainer into the drive bay until it snaps into position.

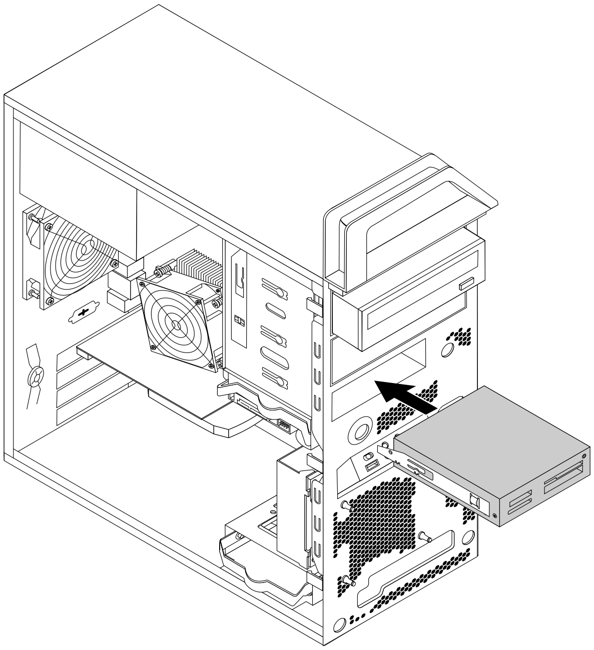


Figure 30. Installing the card reader

9. Reconnect the card reader cable to the front USB connector 2 on the system board. See “Locating parts on the system board” on page 74.
10. Reinstall the front bezel. See “Removing and reinstalling the front bezel” on page 87.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 147.

Replacing the front audio and USB assembly

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the front audio and USB assembly.

To replace the front audio and USB assembly, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 86.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 87.
4. Locate the front audio and USB assembly. See “Locating major FRUs and CRUs” on page 71.
5. Note the cable routing and connection. Then, disconnect the front audio and USB assembly cables from the system board. See “Locating parts on the system board” on page 74.

6. Remove the screw that secures the front audio and USB assembly. Then, remove the front audio and USB assembly from the chassis.

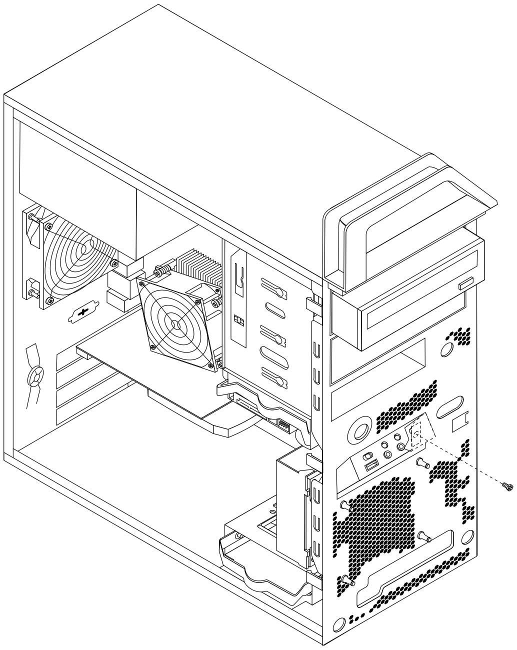


Figure 31. Removing the front audio and USB assembly

7. Route the cables of the new front audio and USB assembly through the corresponding square hole in the front of the chassis. Then position the new front audio and USB assembly on the chassis as shown.

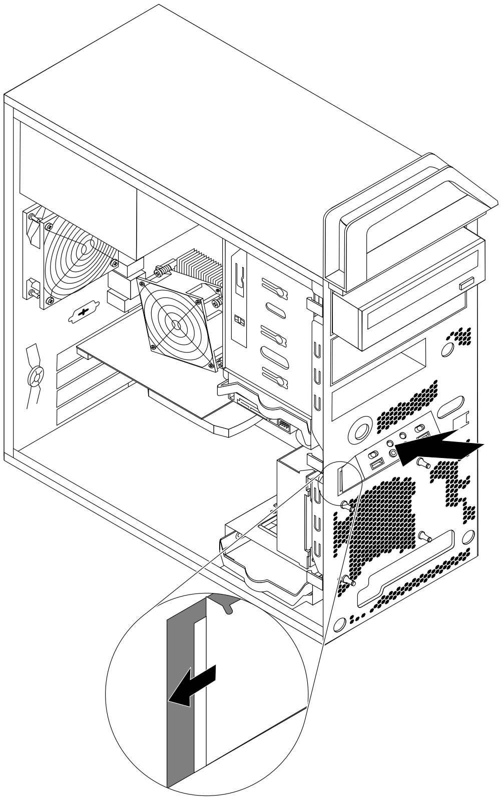


Figure 32. Installing the front audio and USB assembly

8. Install the screw to secure the new front audio and USB assembly in place.

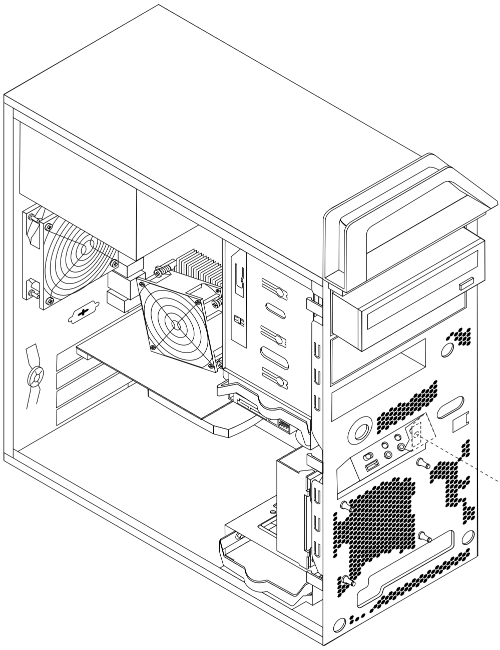


Figure 33. Installing the screw to secure the front audio and USB assembly

9. Connect the cables of the new front audio and USB assembly cables to the front audio connector and the front USB connector on the system board. See "Locating parts on the system board" on page 74.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 147.

Replacing the battery

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

Your computer has a special type of memory that maintains the date, time, and settings for built-in features, such as parallel-port assignments (configuration). A battery keeps this information active when you turn off the computer.

The battery normally requires no charging or maintenance throughout its life; however, no battery lasts forever. If the battery fails, the date, time, and configuration information (including passwords) are lost. An error message is displayed when you turn on the computer.

Refer to the "Lithium battery notice" in the *Safety, Warranty, and Setup Guide* for information about replacing and disposing of the battery.

To replace the battery, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 150.

3. Depending on your computer model, you might need to remove the PCI Express x 16 graphics card for easier access to the battery. See “Installing or replacing a PCI card” on page 88.
4. Remove the old battery.

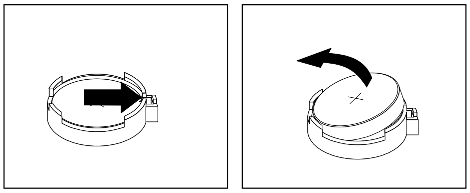


Figure 34. Removing the old battery

5. Install a new battery.

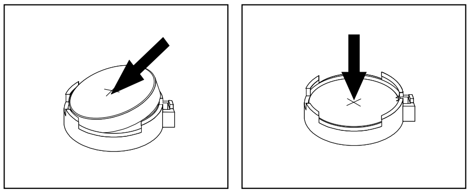


Figure 35. Installing a new battery

6. Reinstall the PCI Express x 16 graphics card if you had removed it. See “Installing or replacing a PCI card” on page 88.
7. Reinstall the computer cover and reconnect the cables. See “Completing the parts replacement” on page 147.

   Note: When the computer is turned on for the first time after replacing the battery, an error message might be displayed. This is normal after replacing the battery.
8. Turn on the computer and all attached devices.
9. Use the Setup Utility program to set the date, time, and any passwords. See Chapter 6 “Using the Setup Utility program” on page 55.

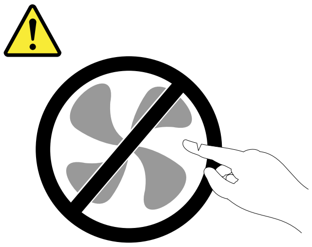
Replacing the power supply assembly

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the power supply assembly.

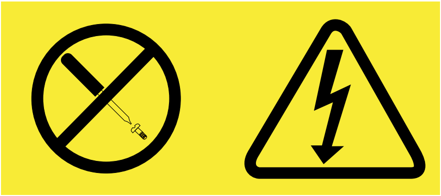
Although there are no moving parts in your computer after the power cord has been disconnected, the following warnings are required for your safety and proper Underwriters Laboratories (UL) certification.

CAUTION:



Hazardous moving parts. Keep fingers and other body parts away.

CAUTION:
Never remove the cover on a power supply or any part that has the following label attached.



Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

To replace the power supply assembly, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 86.
3. Disconnect the power supply assembly cables from the system board and all drives. See “Locating parts on the system board” on page 74.
4. Release the power supply assembly cables from the cable clips and ties in the chassis.

5. Lay the computer on its side and remove the four screws at the rear of the chassis that secure the power supply assembly.

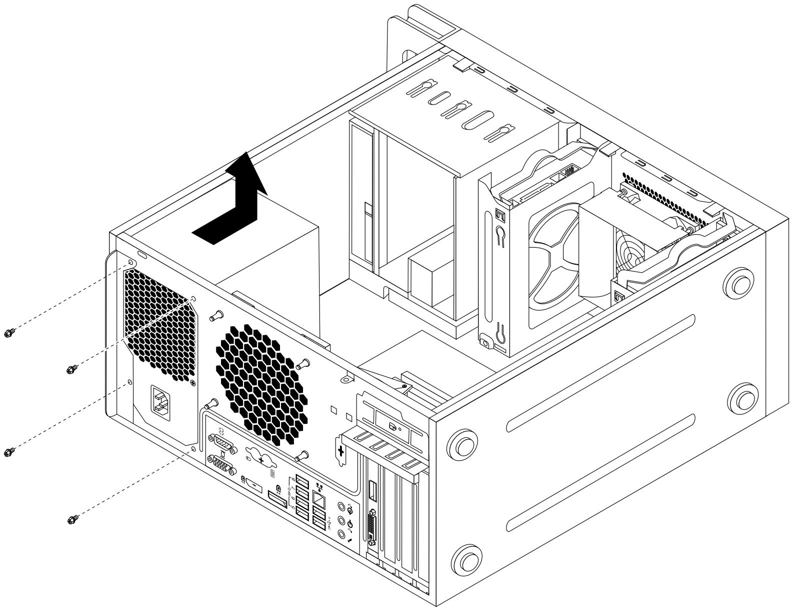


Figure 36. Removing the screws for the power supply assembly

6. Slide the power supply assembly to the front of the computer and then lift it out of the chassis.
7. Ensure that the new power supply assembly is the correct replacement.
8. Install the new power supply assembly into the chassis so that the screw holes in the power supply assembly align with those in the chassis.
9. Install and tighten the four screws to secure the power supply assembly.

   Note: Use only screws provided by Lenovo.
10. Reconnect the power supply assembly cables to the system board and each of the drives.
11. Secure the power supply assembly cables with the cable clips and ties in the chassis.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 147.

Replacing the heat sink and fan assembly

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to replace the heat sink and fan assembly.

CAUTION:

The heat sink and fan assembly might be very hot. Before you open the computer cover, turn off the computer and wait several minutes until the computer is cool.

To replace the heat sink and fan assembly, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 86.
3. Lay the computer on its side for easier access to the system board.
4. Locate the heat sink and fan assembly. See "Locating parts on the system board" on page 74.
5. Disconnect the heat sink and fan assembly cable from the microprocessor fan connector on the system board. See "Locating parts on the system board" on page 74.
6. Follow this sequence to remove the four screws that secure the heat sink and fan assembly to the system board:
   a. Partially remove screw **1**, then fully remove screw **2**, and then fully remove screw **1**.
   b. Partially remove screw **3**, then fully remove screw **4**, and then fully remove screw **3**.

   Note: Carefully remove the four screws from the system board to avoid any possible damage to the system board. The four screws cannot be removed from the heat sink and fan assembly.

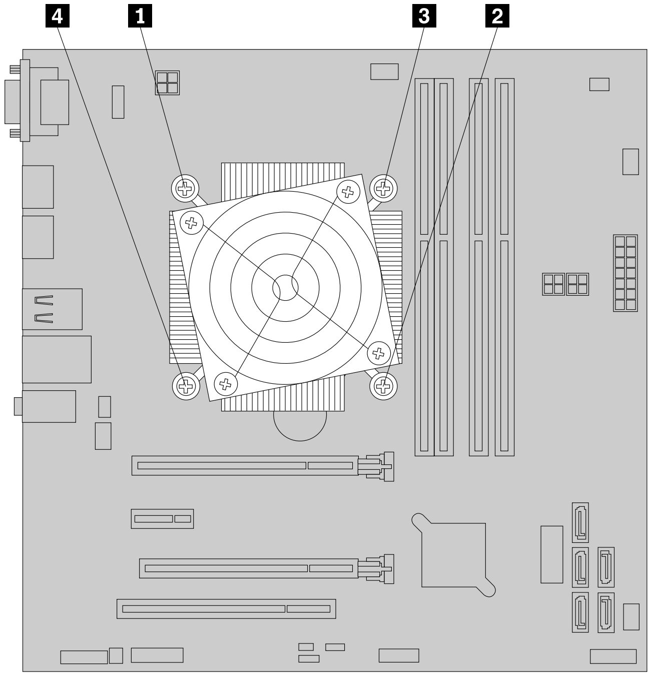


Figure 37. Removing the heat sink and fan assembly

7. Lift the failing heat sink and fan assembly off the system board.

   Notes:

   a. You might have to gently twist the heat sink and fan assembly to free it from the microprocessor.
   b. Do not touch the thermal grease while handling the heat sink and fan assembly.
8. Position the new heat sink and fan assembly on the system board so that the four screws are aligned with the holes on the system board.

   Note: Position the new heat sink and fan assembly so that the heat sink and fan assembly cable is toward the microprocessor fan connector on the system board.
9. Follow the following sequence to install the four screws to secure the new heat sink and fan assembly. Do not over-tighten the screws.
   a. Partially tighten screw **1**, then fully tighten screw **2**, and then fully tighten screw **1**.

b. Partially tighten screw **3**, then fully tighten screw **4**, and then fully tighten screw **3**.

10. Connect the heat sink and fan assembly cable to the microprocessor fan connector on the system board. See "Locating parts on the system board" on page 74.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 147.

Installing the solid-state drive

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to install the 2.5-inch solid-state drive.

To install the solid-state drive, do the following:

1. Install the solid-state drive into the storage converter. Then, install the four screws to secure the solid-state drive to the storage converter.

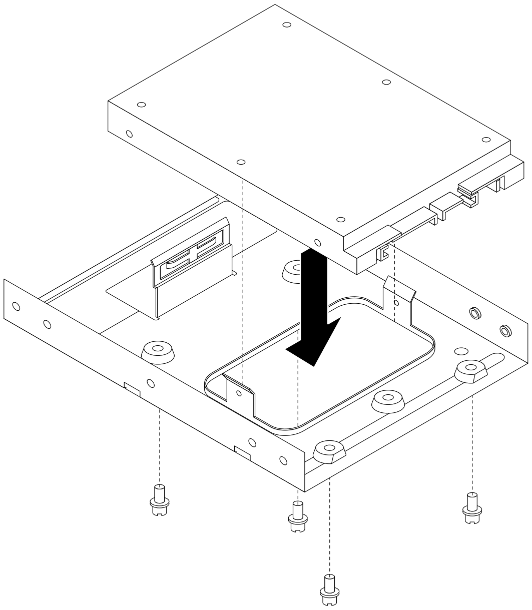


Figure 38. Installing the solid-state drive into the storage converter

2. To install the solid-state drive with the storage converter into the 3.5-inch hard disk drive bracket, flex the bracket and align pin **1**, pin **2**, pin **3**, and pin **4** on the bracket with the corresponding holes in the storage converter.

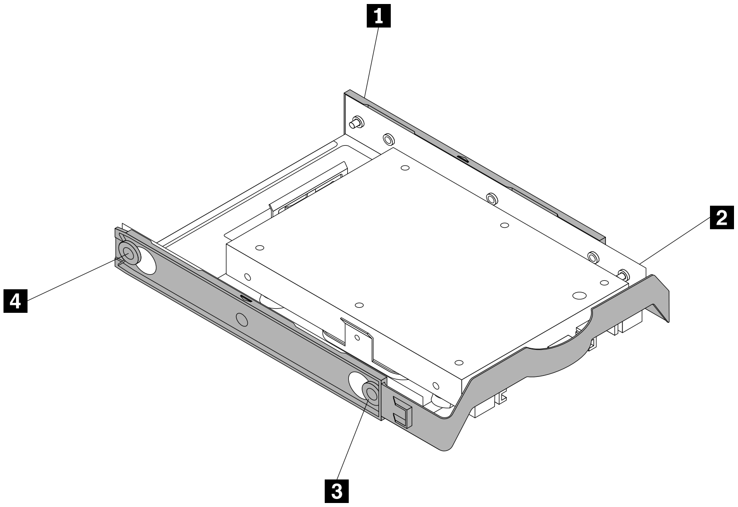


Figure 39. Installing the solid-state drive with the storage converter into the hard disk drive bracket

3. Connect the signal cable and the power cable to the solid-state drive.
4. Install the solid-state drive into the desired hard disk drive bay. See "Replacing the primary hard disk drive" on page 123 or "Replacing the secondary hard disk drive" on page 125.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 147.

Installing or replacing the mSATA solid-state drive

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to install or replace the mSATA solid-state drive.

Note: The mSATA solid-state drive is only available in some models. For new installation, see "Installing the card reader" on page 96. For replacement, see "Replacing the card reader" on page 98.

Installing the mSATA solid-state drive

To install the mSATA solid-state drive, do the following:

1. Insert the mSATA solid-state drive into the mini PCI Express slot on the storage converter, and then press the mSATA solid-state drive downward.

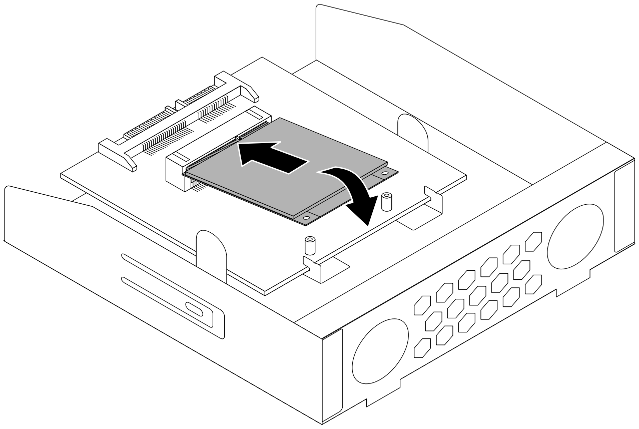


Figure 40. Installing the mSATA solid-state drive into the storage converter

2. Install the two screws to secure the mSATA solid-state drive to the storage converter.

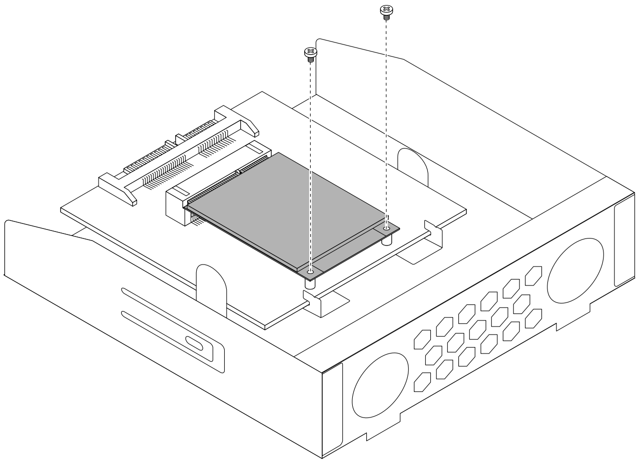


Figure 41. Installing the screws that secure the mSATA solid-state drive

3. Slide the mSATA solid-state drive storage converter into the card reader drive bay until it snaps into position.

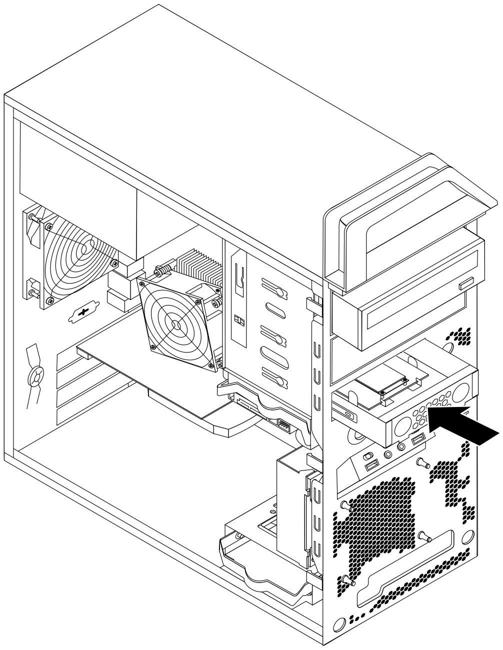


Figure 42. Installing the mSATA solid-state drive

4. Connect the signal cable and the power cable to the mSATA solid-state drive.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 147.

Replacing the mSATA solid-state drive

To replace the mSATA solid-state drive, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See "Removing the computer cover" on page 86.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 87.
4. Locate the card reader. See "Locating major FRUs and CRUs" on page 71.
5. Disconnect the signal cable and power cable from the mSATA solid-state drive.

6. Press the blue retaining clip to remove the mSATA solid-state drive storage converter out of the chassis.

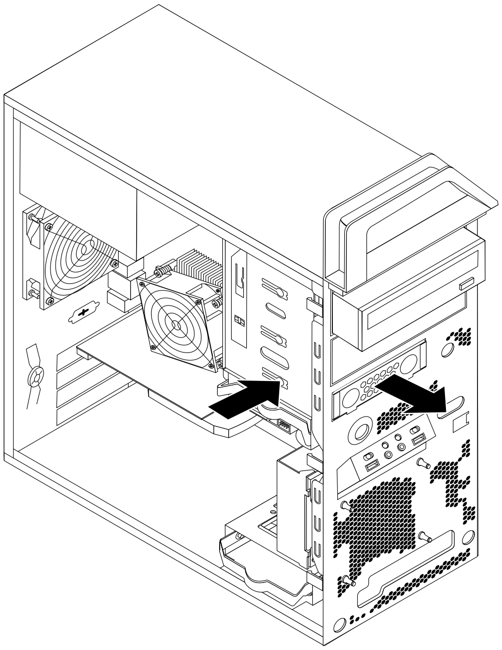


Figure 43. Removing the mSATA solid-state drive storage converter

7. Remove the two screws that secure the mSATA solid-state drive from the storage converter.

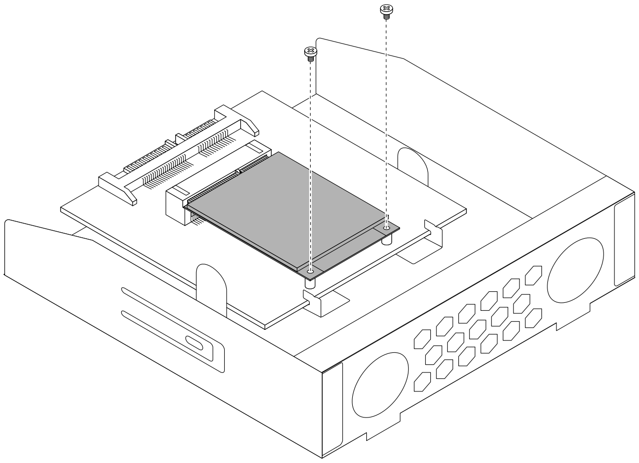


Figure 44. Removing the screws that secure the mSATA solid-state drive

8. Pull the mSATA solid-state drive from the mini PCI Express slot on the storage converter.

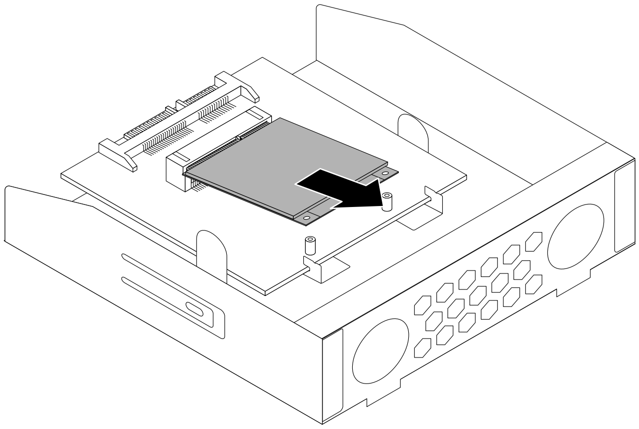


Figure 45. Removing the mSATA solid-state drive

9. To install a new mSATA solid-state drive, insert the mSATA solid-state drive into the mini PCI Express slot on the storage converter, and then press the mSATA solid-state drive downward.

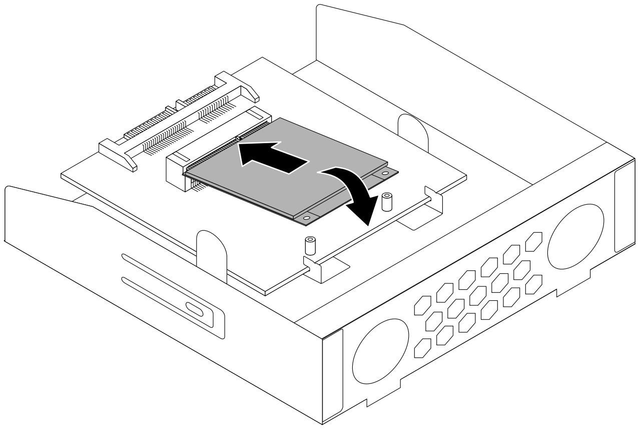


Figure 46. Installing the mSATA solid-state drive into the storage converter

10. Install the two screws to secure the mSATA solid-state drive to the storage converter.

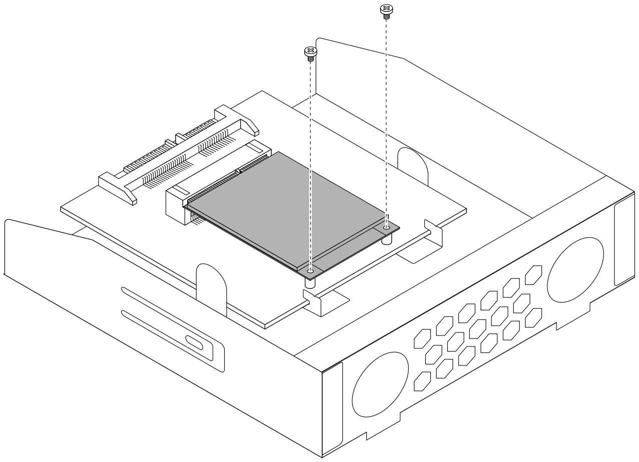


Figure 47. Installing the screws that secure the mSATA solid-state drive

11. Slide the mSATA solid-state drive storage converter into the card reader drive bay until it snaps into position.

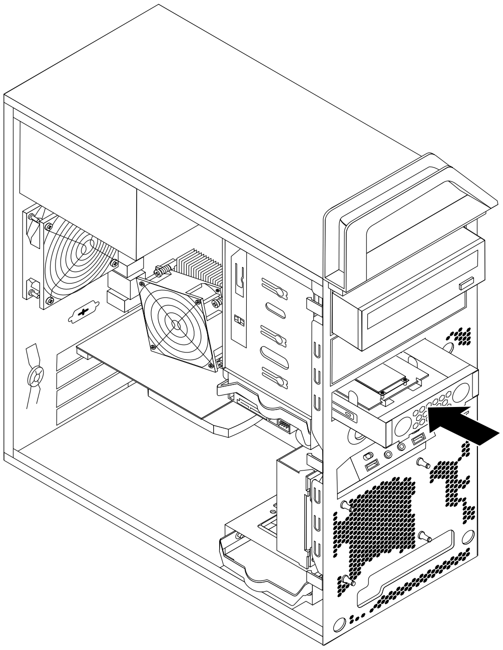


Figure 48. Installing the mSATA solid-state drive

12. Connect the signal cable and the power cable to the mSATA solid-state drive.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 147.

Replacing the internal speaker

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to replace the internal speaker.

Note: The internal speaker is only available in some models.

To replace the internal speaker, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 86.
3. Locate the internal speaker connector on the system board. See "Locating parts on the system board" on page 74.
4. Disconnect the internal speaker cable from the system board.
5. Push the metal tab **1** on the right side of the internal speaker and slide the internal speaker toward the right to completely remove it from the chassis.

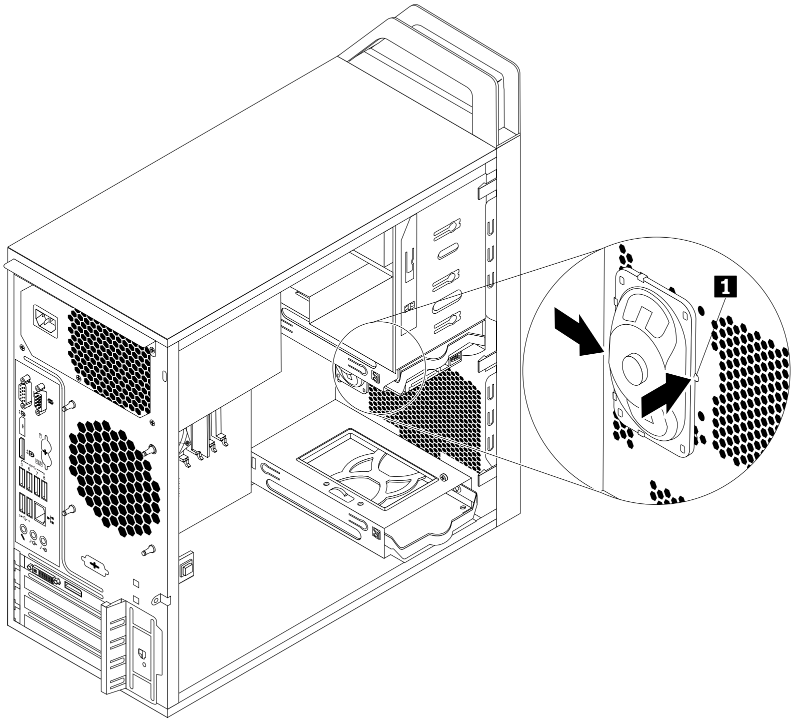


Figure 49. Removing the old internal speaker

6. Position the new internal speaker into the four metal clips **1** and push the internal speaker toward the left until it is secured in place.

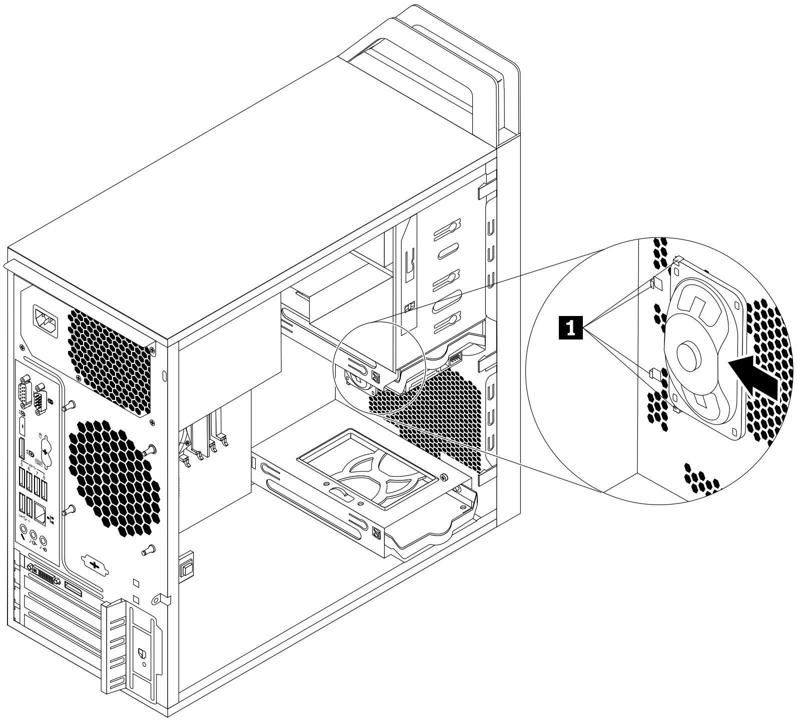


Figure 50. Installing a new internal speaker

7. Connect the internal speaker cable to the system board. See "Locating parts on the system board" on page 74.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 147.

Replacing the thermal sensor

Attention:
Do not open your computer or attempt any repair before reading and understanding the "Important safety information" on page 1.

This section provides instructions on how to replace the thermal sensor.

To replace the thermal sensor, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 86.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 87.
4. Locate the thermal sensor. See "Locating major FRUs and CRUs" on page 71.
5. Disconnect the thermal sensor cable from the thermal sensor connector on the system board. See "Locating parts on the system board" on page 74.

6. From inside the chassis, pivot the upper retaining clip **1** that secures the plastic holder of the thermal sensor downward and then push the clip outward to release the clip. Then disengage the plastic holder holding the thermal sensor from the chassis.

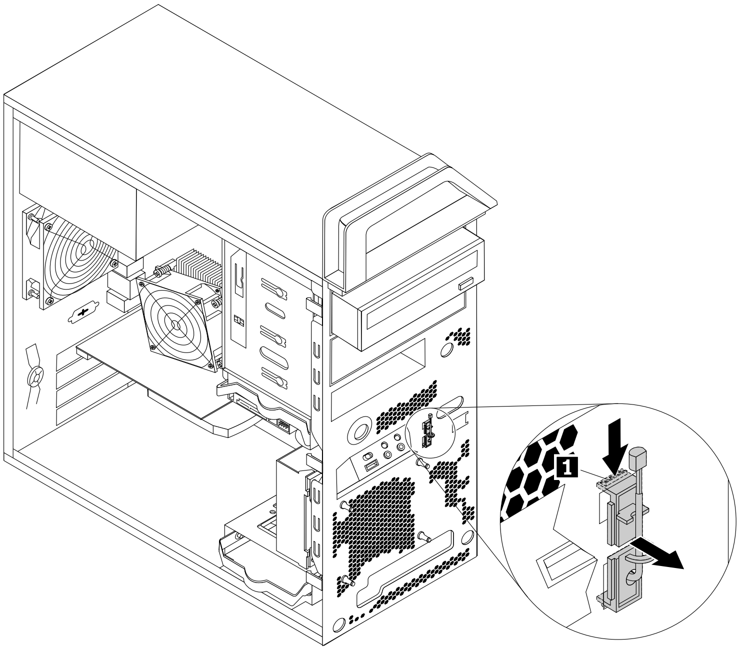


Figure 51. Removing the thermal sensor

7. Pull the entire thermal sensor out of the chassis.

8. Insert the connector and cable of the new thermal sensor into the lower hole **1** in the chassis. Then align the two tabs on the plastic holder holding the thermal sensor with the two holes **1** and **2** in the chassis, and push the plastic holder until it snaps into position.

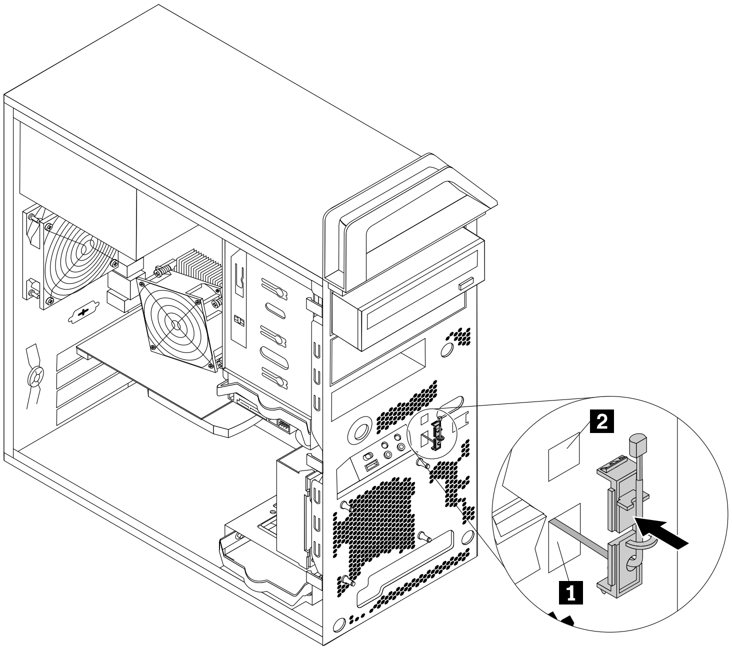


Figure 52. Installing the new thermal sensor

9. Reconnect the thermal sensor cable to the system board. See “Locating parts on the system board” on page 74.
10. Reinstall the front bezel. See “Removing and reinstalling the front bezel” on page 87.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 147.

Replacing the front fan assembly

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the front fan assembly.

Note: The front fan assembly is only available in some models.

To replace the front fan assembly, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 86.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 87.
4. Disconnect the front fan assembly cable from the power fan connector on the system board. See “Locating parts on the system board” on page 74.

5. The front fan assembly is attached to the chassis by four rubber mounts. Remove the front fan assembly by breaking or cutting the rubber mounts and gently pulling the front fan assembly out of the chassis.

   Note: The new front fan assembly will have four new rubber mounts attached.

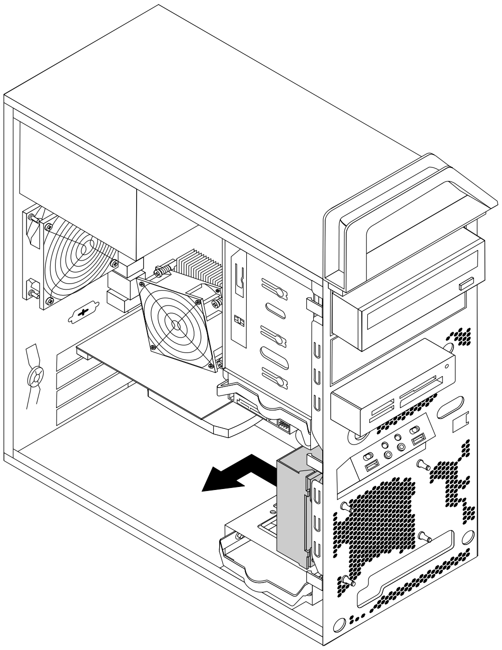


Figure 53. Removing the front fan assembly

6. Install the new front fan assembly by aligning the new rubber mounts with the corresponding holes in the chassis and push the rubber mounts through the holes

7. Pull the tips of the rubber mounts until the front fan assembly is secured in place.

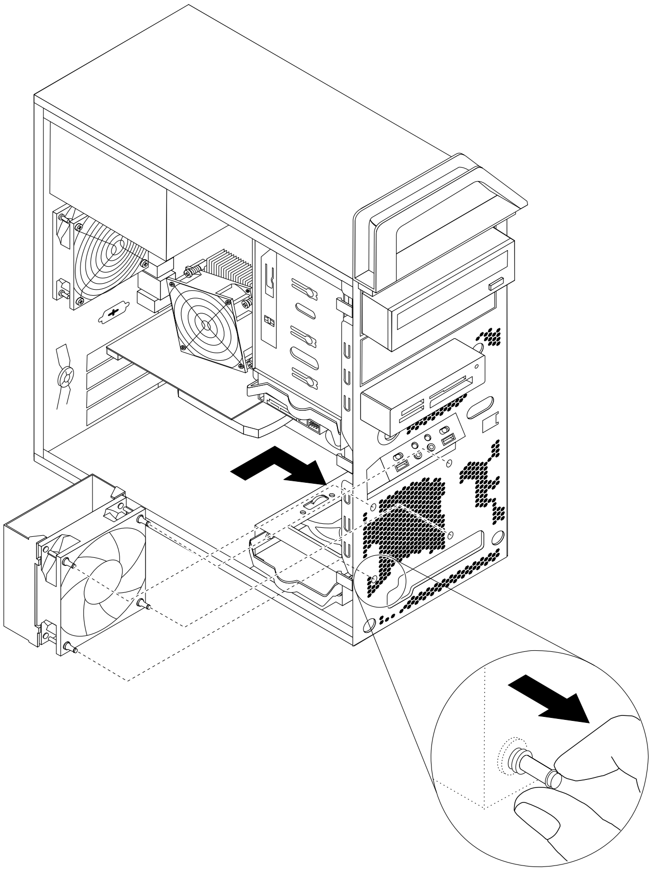


Figure 54. Installing the front fan assembly

8. Connect the front fan assembly cable to the power fan connector on the system board.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 147.

Replacing the rear fan assembly

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the rear fan assembly.

To replace the rear fan assembly, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 86.
3. Locate the rear fan assembly. See “Locating major FRUs and CRUs” on page 71.
4. Disconnect the rear fan assembly cable from the system fan connector on the system board. See “Locating parts on the system board” on page 74.

5. The rear fan assembly is attached to the chassis by four rubber mounts. Remove the rear fan assembly by breaking or cutting the rubber mounts and gently pulling the rear fan assembly out of the chassis.

   Note: The new rear fan assembly will have four new rubber mounts attached.

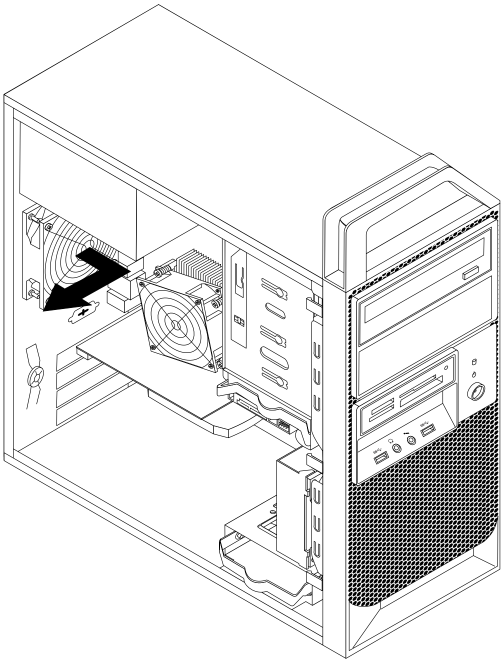


Figure 55. Removing the rear fan assembly

6. Install the new rear fan assembly by aligning the new rubber mounts with the corresponding holes in the chassis and push the rubber mounts through the holes.

7. Pull on the tips of the rubber mounts until the rear fan assembly is secured in place.

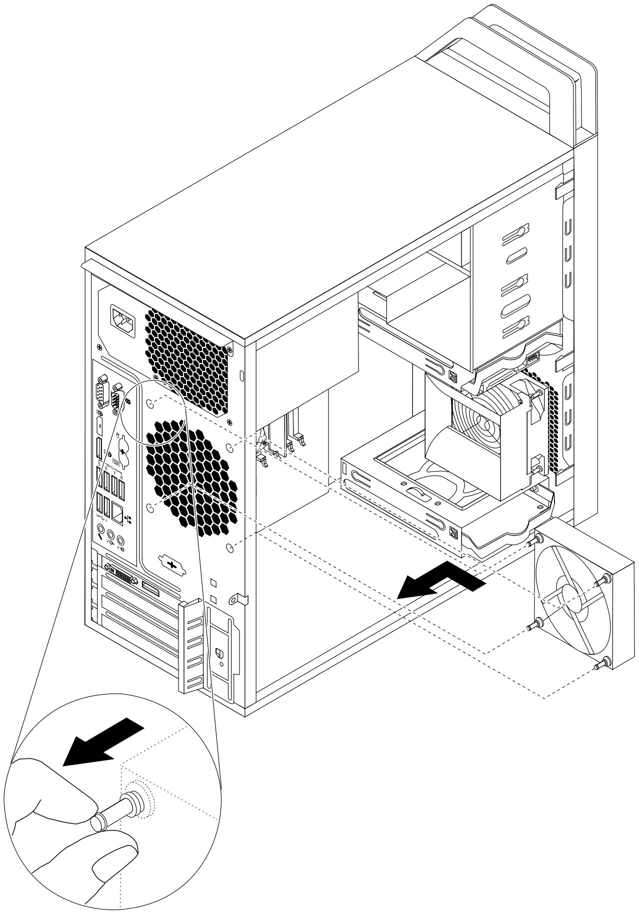


Figure 56. Installing the rear fan assembly

8. Connect the rear fan assembly cable to the system fan connector on the system board.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 147.

Replacing the cover presence switch

Attention:
Do not open your computer or attempt any repair before reading and understanding the “Important safety information” on page 1.

This section provides instructions on how to replace the cover presence switch (intrusion switch).

To replace the cover presence switch, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 86.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 87.
4. Locate the cover presence switch. See “Locating major FRUs and CRUs” on page 71.

5. Disconnect the cover presence switch cable from the cover presence switch connector on the system board. See “Locating parts on the system board” on page 74.
6. Remove the screw that secures the cover presence switch and remove the cover presence switch from the chassis.

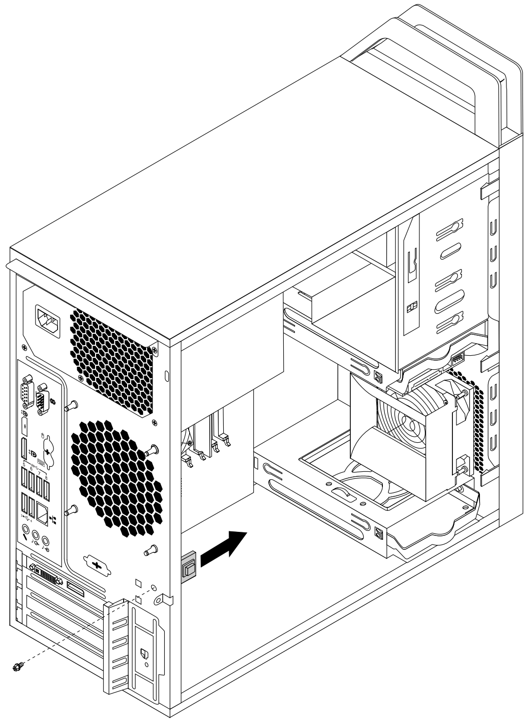


Figure 57. Removing the cover presence switch

7. Position the new cover presence switch so that the screw hole in the cover presence switch is aligned with the corresponding hole in the chassis. Then install the screw to secure the cover presence switch to the chassis.

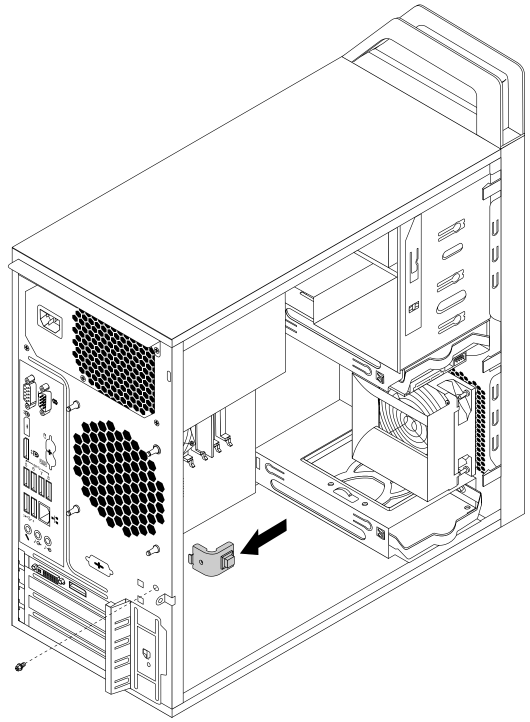


Figure 58. Installing the cover presence switch

8. Reconnect the cover presence switch cable to the system board. See “Locating parts on the system board” on page 74.
9. Reinstall the front bezel. See “Removing and reinstalling the front bezel” on page 87.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 147.

Replacing the primary hard disk drive

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the primary hard disk drive.

Note: This section also applies to computer models with a 2.5-inch solid-state drive.

To replace the primary hard disk drive, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 86.
3. Locate the primary hard disk drive. See “Locating internal drives” on page 76.
4. Disconnect the signal cable and the power cable from the hard disk drive.

5. Pull the blue handle to release and remove the hard disk drive from the drive cage.

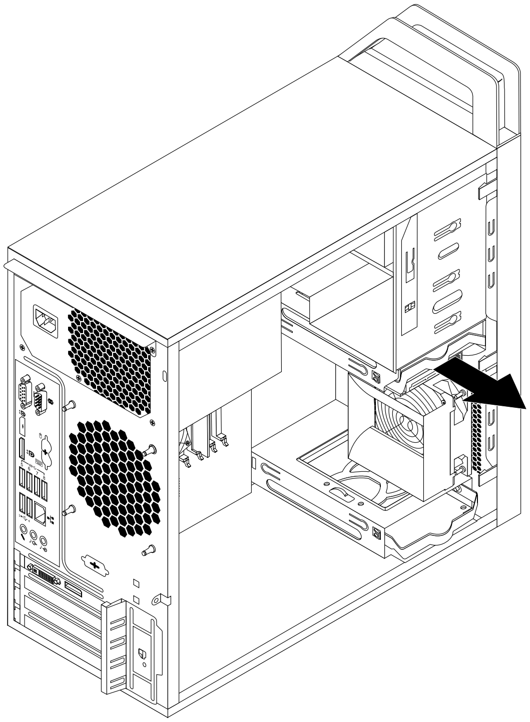


Figure 59. Removing the primary hard disk drive

6. Flex the sides of the blue bracket to remove the hard disk drive from the bracket.
7. To install a new hard disk drive into the blue bracket, flex the bracket and align pin **1**, pin **2**, pin **3**, and pin **4** on the bracket with the corresponding holes in the hard disk drive. Do not touch the circuit board **5** on the bottom of the hard disk drive.

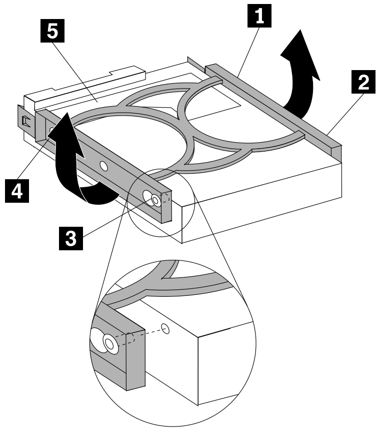


Figure 60. Installing the hard disk drive into the bracket

8. Slide the new hard disk drive into the drive cage until it snaps into position.

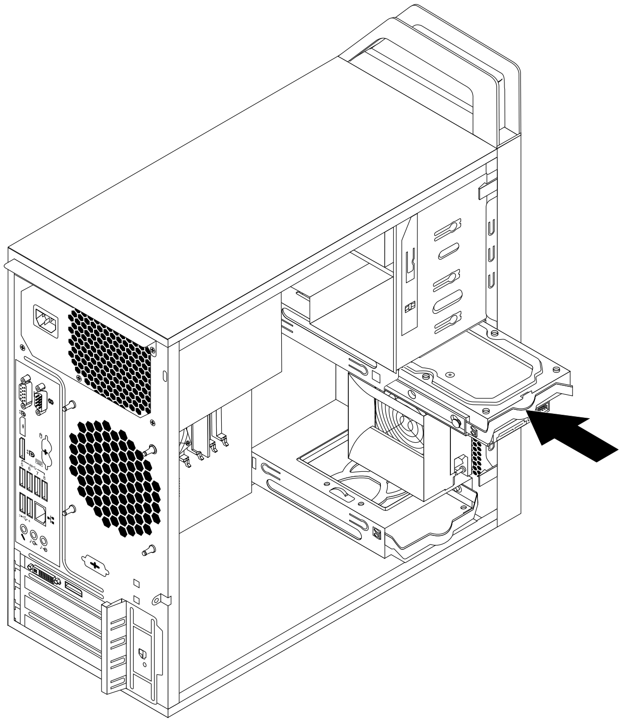


Figure 61. Installing the primary hard disk drive

9. Connect the signal cable and the power cable to the new hard disk drive.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 147.

Replacing the secondary hard disk drive

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

Note: Your computer comes with a secondary hard disk drive bay for installing or replacing a secondary 3.5-inch hard disk drive or a 2.5-inch solid state drive.

This section provides instructions on how to replace the secondary hard disk drive.

To replace the secondary hard disk drive, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 86.
3. Locate the secondary hard disk drive. See “Locating internal drives” on page 76.
4. Disconnect the signal cable and the power cable from the hard disk drive.

5. Pull the blue handle to release and remove the hard disk drive from the hard disk drive cage.

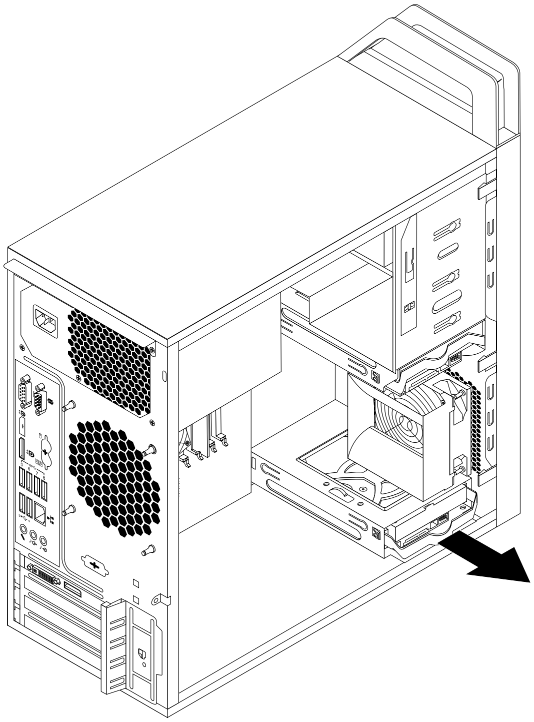


Figure 62. Removing the secondary hard disk drive

6. Flex the sides of the blue bracket to remove the hard disk drive from the bracket.
7. To install a new hard disk drive into the blue bracket, flex the bracket and align pin **1**, pin **2**, pin **3**, and pin **4** on the bracket with the corresponding holes in the hard disk drive. Do not touch the circuit board **5** on the bottom of the hard disk drive.

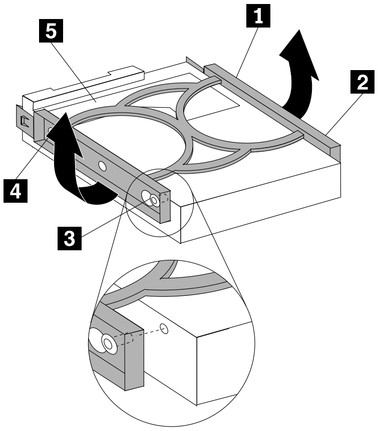


Figure 63. Installing the hard disk drive into the bracket

8. Slide the new hard disk drive into the hard disk drive cage until it snaps into position.

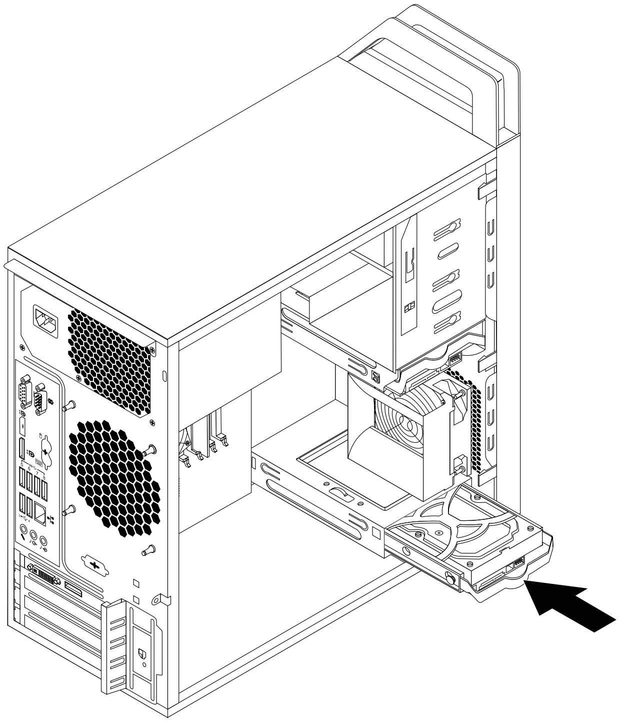


Figure 64. Installing the secondary hard disk drive

9. Connect the signal cable and the power cable to the new hard disk drive.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 147.

Installing the tertiary hard disk drive

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

Note: You can install a tertiary 3.5-inch hard disk drive or a 2.5-inch solid state drive into the secondary optical drive bay in your computer.

This section provides instructions on how to install a tertiary 3.5-inch hard disk drive or a 2.5-inch solid state drive.

To install a tertiary 3.5-inch hard disk drive or a 2.5-inch solid state drive, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 86.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 87.
4. Remove the plastic panel in the front bezel for the drive bay you want to use. If there is a metal static shield installed in the drive bay, remove the metal static shield.

5. Depending on whether you are installing a tertiary 3.5-inch hard disk drive or a 2.5-inch solid state drive, do one of the following:
    - Install the hard disk drive into the 5.25-inch optical drive bracket. Then, fully tighten the four screws to secure the hard disk drive to the 5.25-inch optical drive bracket.

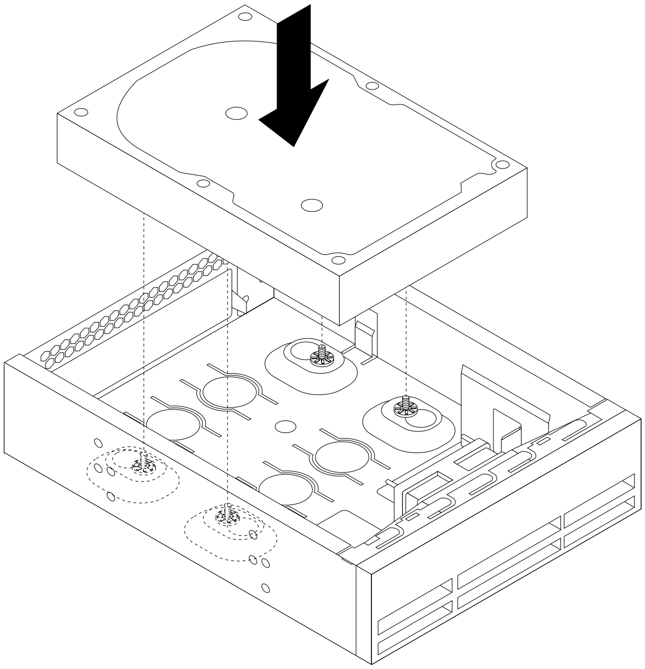


Figure 65. Installing the tertiary hard disk drive

    - Install the solid state drive into the 5.25-inch optical drive bracket. To install the solid state drive into the 5.25-inch optical drive bracket, do the following:

a. Install the solid state drive into the storage converter. Then, install the five screws to secure the solid state drive to the storage converter.

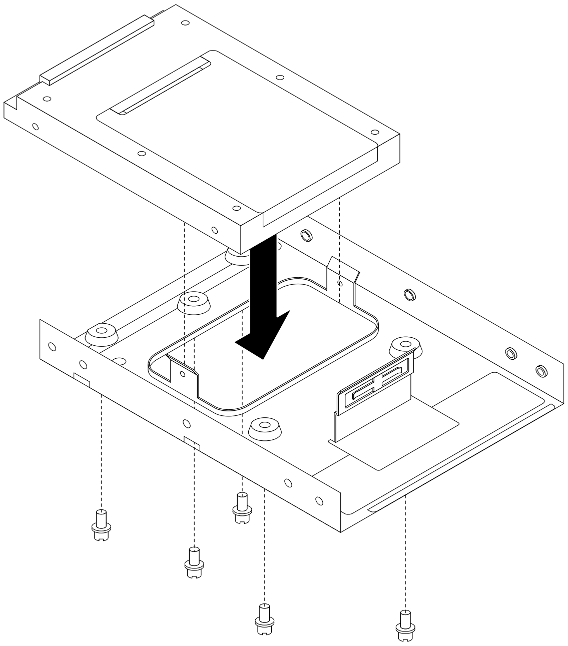


Figure 66. Installing the solid state drive into the storage converter

b. Install the solid state drive with the storage converter into the 5.25-inch optical drive bracket. Then, fully tighten the four screws to secure the solid state drive with the storage converter to the 5.25-inch optical drive bracket.

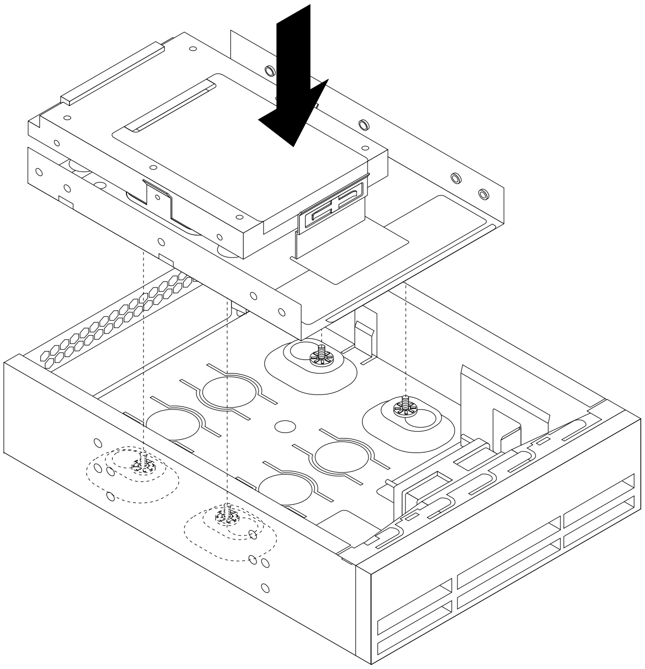


Figure 67. Installing the solid-state drive with the storage converter

6. Install the optical drive retainer on the side of the optical drive bracket.

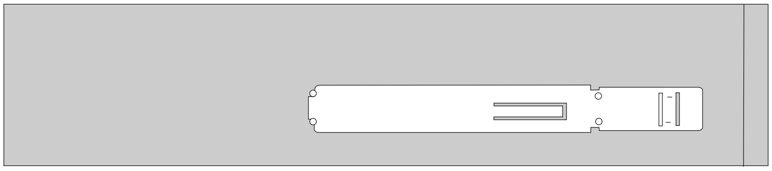


Figure 68. Installing the optical drive retainer

7. Slide the optical drive bracket into the secondary optical drive bay from the front of the computer until the optical drive bracket snaps into position.

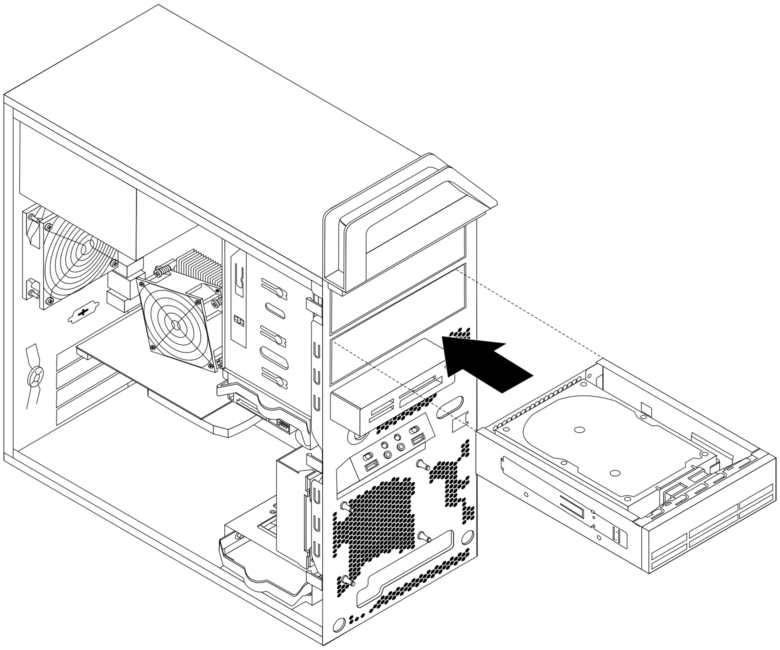


Figure 69. Installing the optical drive bracket

8. Connect the signal cable and the power cable to the new hard disk drive or solid state drive.

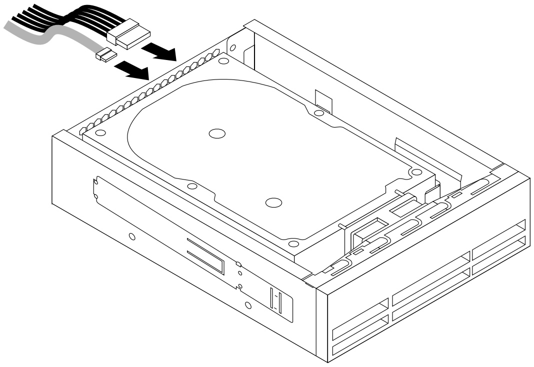


Figure 70. Connecting the hard disk drive or solid-state drive

9. Reinstall the front bezel. See “Removing and reinstalling the front bezel” on page 87.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 147.

Replacing the microprocessor

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the microprocessor.

CAUTION:

The heat sink and microprocessor might be very hot. Before you open the computer cover, turn off the computer and wait several minutes until the computer is cool.

To replace the microprocessor, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See “Removing the computer cover” on page 86.
3. Lay the computer on its side for easier access to the system board.
4. Locate the system board and disconnect all cables connected to the system board. See “Locating parts on the system board” on page 74.
5. Remove the heat sink and fan assembly. See “Replacing the heat sink and fan assembly” on page 105.

   Note: Place the heat sink and fan assembly on its side so that the thermal grease on the bottom of it does not get in contact with anything.

6. Lift the small handle **1** and open the retainer **2** to access the microprocessor **3**.

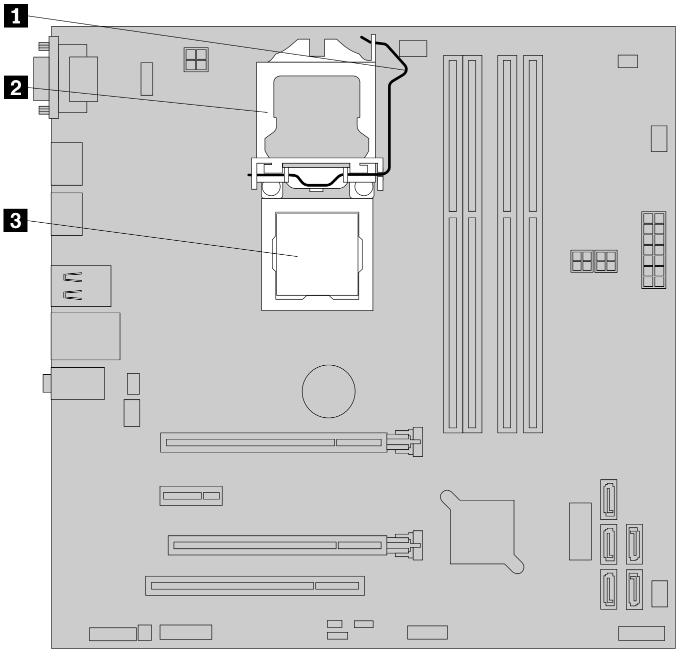


Figure 71. Accessing the microprocessor

7. Lift the microprocessor straight up and out of the microprocessor socket.

   Notes:

   - Your microprocessor and socket might look different from the one illustrated.
   - Touch only the edges of the microprocessor. Do not touch the gold contacts on the bottom.
   - Do not drop anything onto the microprocessor socket while it is exposed. The socket pins must be kept as clean as possible.

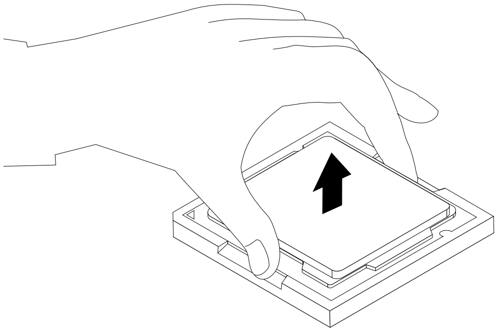


Figure 72. Removing the microprocessor

8. Ensure that the small handle is in the raised position and the microprocessor retainer is fully open.
9. Remove the protective cover that protects the gold contacts of the new microprocessor.

10. Note the orientation of the new microprocessor. Hold the new microprocessor by its edges and align the notches **1** on it with the tabs **2** in the microprocessor socket. Then, carefully lower the new microprocessor straight down into the microprocessor socket.

    Note: The small triangle **3** on one corner of the new microprocessor is the microprocessor orientation indicator. The new microprocessor is in the correct orientation when this indicator points to the beveled corner **4** of the microprocessor socket.

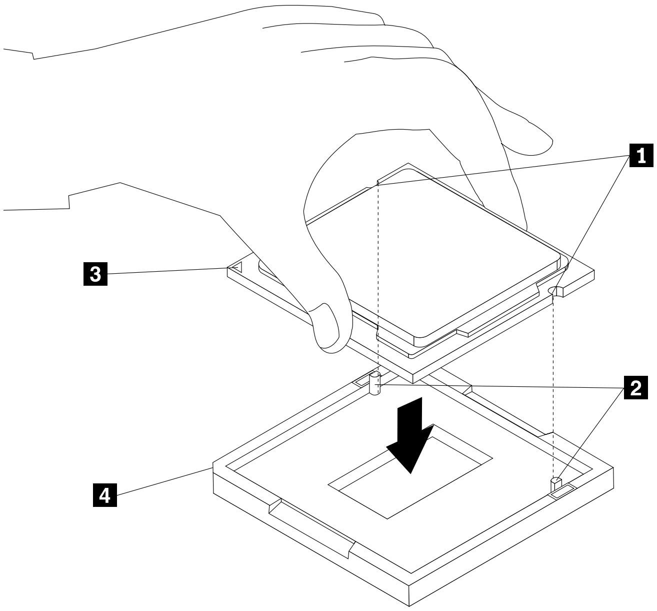


Figure 73. Installing the microprocessor

11. Close the microprocessor retainer and lock it into position with the small handle to secure the new microprocessor in the socket.
12. Reinstall the heat sink and fan assembly. See “Replacing the heat sink and fan assembly” on page 105.
13. Reconnect all cables that were disconnected from the system board.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to “Completing the parts replacement” on page 147.

Replacing the system board

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the system board.

CAUTION:

The heat sink and microprocessor might be very hot. Before you open the computer cover, turn off the computer and wait several minutes until the computer is cool.

To replace the system board, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See “Removing the computer cover” on page 86.
3. Lay the computer on its side for easier access to the system board.
4. Remove all memory modules and PCI cards that are currently installed. See “Installing or replacing a memory module” on page 91 and “Installing or replacing a PCI card” on page 88.
5. Record the cable routing and cable connections and then disconnect all cables from the system board. See “Locating parts on the system board” on page 74.
6. Remove the heat sink and fan assembly from the failing system board. See “Replacing the heat sink and fan assembly” on page 105.
7. Remove the eight screws that secure the system board by following the sequence shown in the following illustration.

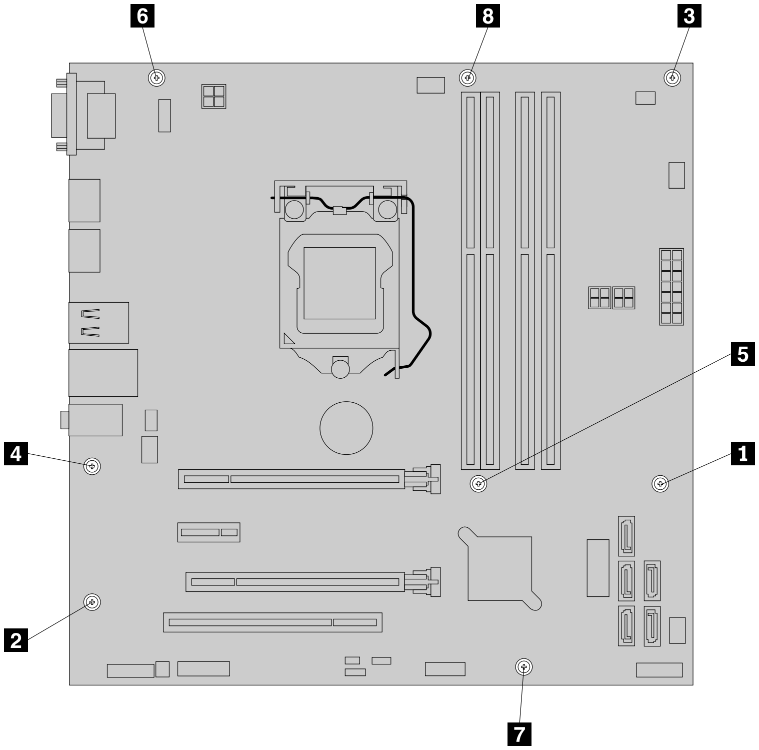


Figure 74. Removing the eight screws that secure the system board

8. Slide the system board to the front of the computer and then carefully lift the system board out of the chassis.
9. Remove the microprocessor from the failing system board and install it on the new system board. See “Replacing the microprocessor” on page 131.

10. Install the new system board into the chassis by aligning the eight screw holes in the new system board with the corresponding mounting studs on the chassis. Then, install the eight screws to secure the system board by following the sequence shown in the following illustration.

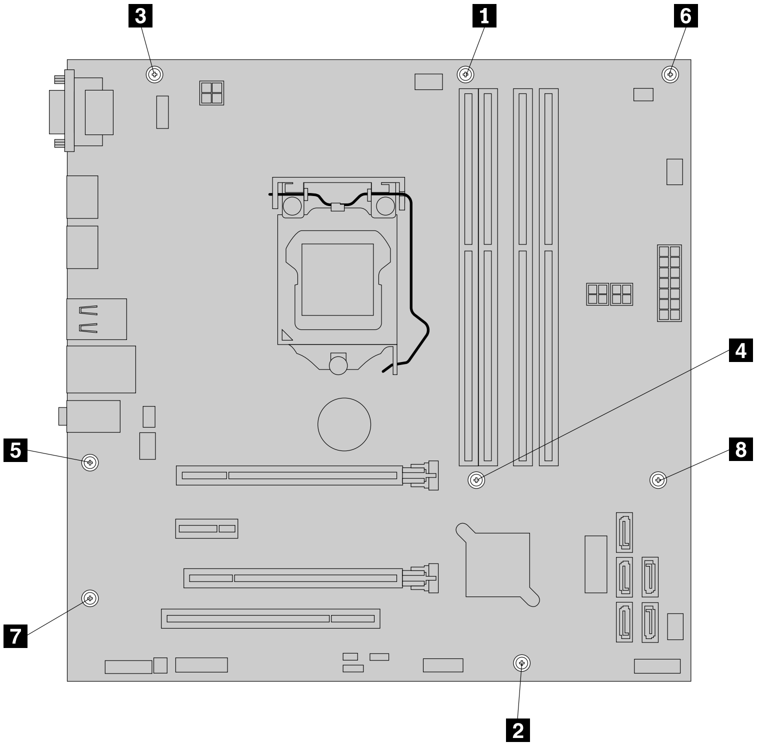


Figure 75. Installing the eight screws to secure the system board

11. Install the heat sink and fan assembly and connect the heat-sink-and-fan-assembly cable to the new system board. See “Replacing the heat sink and fan assembly” on page 105.
12. Install all memory modules and PCI cards removed from the failing system board onto the new system board. See “Installing or replacing a memory module” on page 91 and “Installing or replacing a PCI card” on page 88.
13. Refer to your record to connect cables to the new system board. You also can refer to “Locating parts on the system board” on page 74 to help you locate the connectors on the system board and connect cables.
14. To complete the installation or replacement, go to “Completing the parts replacement” on page 147.

The failing system board must be returned with a microprocessor socket cover to protect the pins during shipping and handling.

To install the microprocessor socket cover, do the following:

1. After you have removed the microprocessor from the failing system board, close the microprocessor retainer and then put the lever to the locked position to secure the retainer in place.

2. Note the orientation of the socket cover, and install one side of the socket cover into the microprocessor socket. Carefully press the other side of the socket cover downward until the socket cover snaps into position.

   Note: Your microprocessor socket and cover might look slightly different from the illustration.

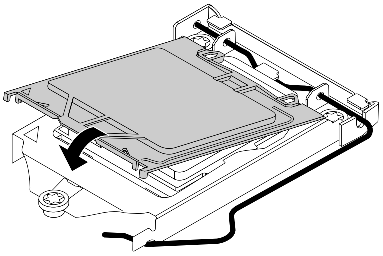


Figure 76. Installing the microprocessor socket cover

3. Carefully check the four corners of the socket cover to ensure that the cover is seated securely.
4. Follow any additional instructions included with the replacement part you received.

Replacing the Wi-Fi units

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to replace the Wi-Fi units. The Wi-Fi units include a Wi-Fi adapter card, a Wi-Fi card module, and a rear Wi-Fi antenna cable.

Replacing the Wi-Fi units involves the following operations:

- "Removing the Wi-Fi adapter card" on page 136
- "Removing the Wi-Fi card module" on page 139
- "Installing the Wi-Fi units" on page 140

Removing the Wi-Fi adapter card

To remove a Wi-Fi adapter card, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 86.

3. If your computer comes with a Wi-Fi card module that supports the Bluetooth function, disconnect the Bluetooth cable from the Wi-Fi adapter card.

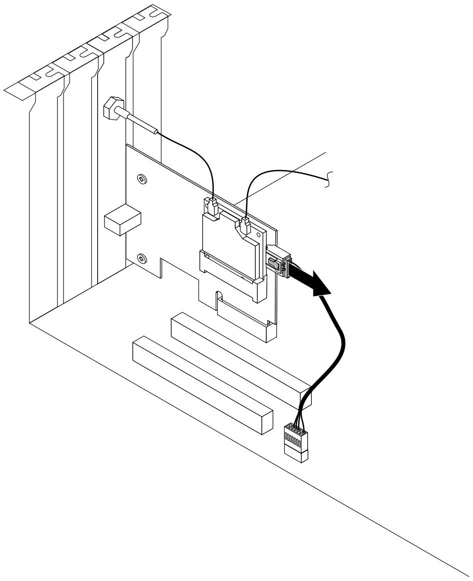


Figure 77. Disconnecting the Bluetooth cable

Note: The Bluetooth cable connects the Bluetooth connector on the Wi-Fi adapter card to the front USB connector on the system board to support the Bluetooth function.

4. At the rear of the computer, press the release button **1** to open the PCI card latch **2**.

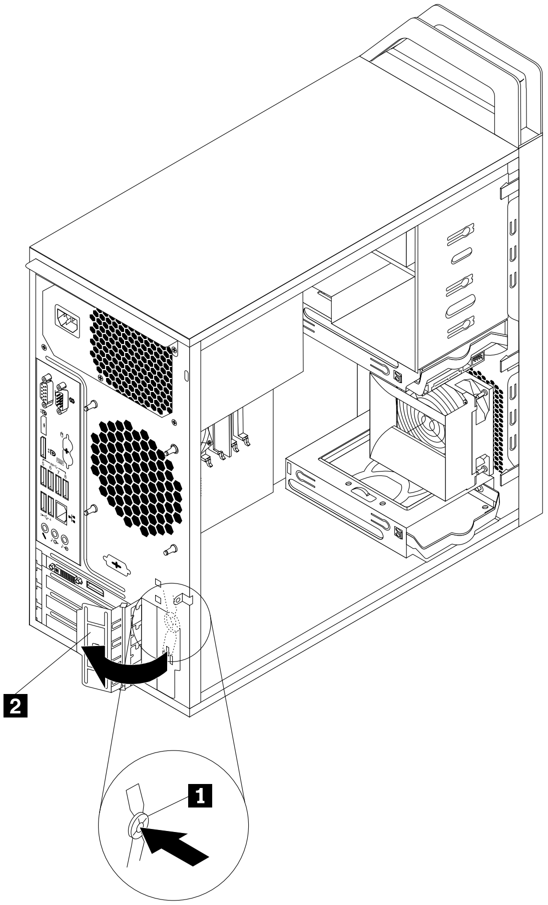


Figure 78. Opening the PCI card latch

5. Grasp the Wi-Fi adapter card that is currently installed and gently pull it out of the slot.

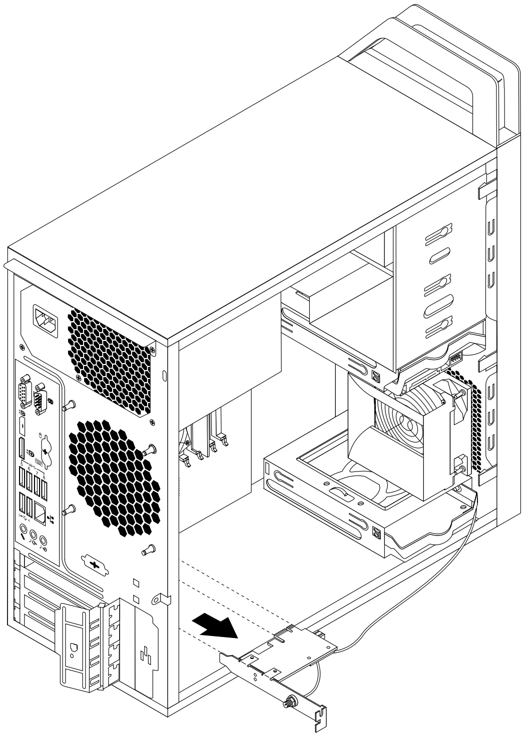


Figure 79. Removing the Wi-Fi adapter card

Note: The card fits tightly into the card slot. If necessary, alternate moving each side of the card a small amount until it is removed from the card slot.

Removing the Wi-Fi card module

To remove the Wi-Fi card module, do the following:

1. Remove the Wi-Fi adapter card from the computer, and then disconnect the front and rear Wi-Fi antenna cables from the Wi-Fi card module.

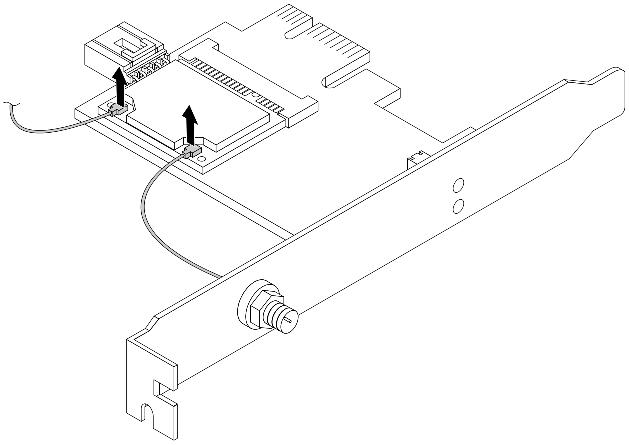


Figure 80. Removing the Wi-Fi antenna cables

2. Remove the two screws that secure the Wi-Fi card module to the Wi-Fi adapter card.

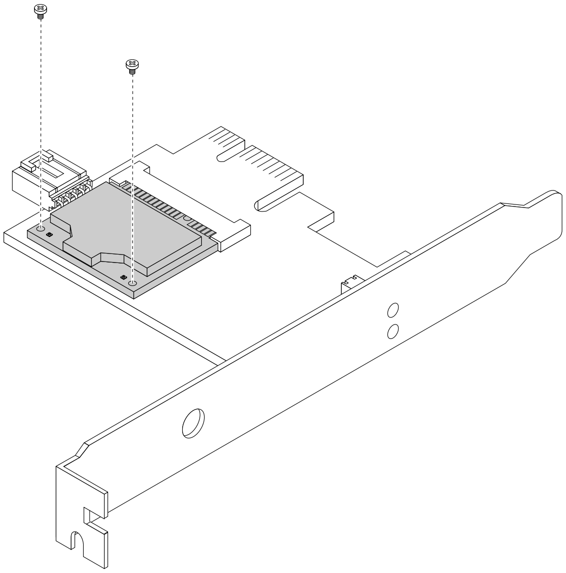


Figure 81. Removing the screws that secure the Wi-Fi card module

3. Pull the Wi-Fi card module out of the mini PCI Express slot to remove it from the Wi-Fi adapter card.

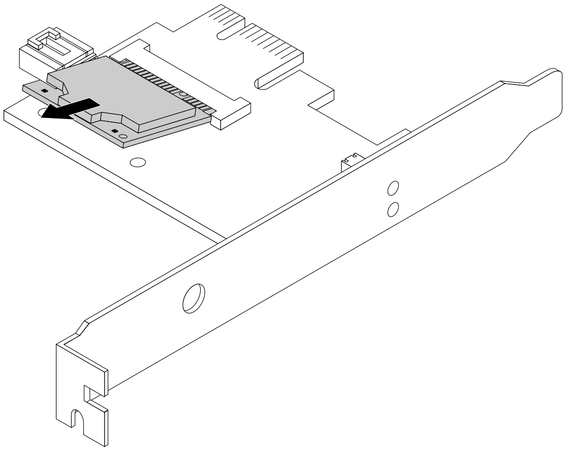


Figure 82. Removing the Wi-Fi card module

Installing the Wi-Fi units

To install the Wi-Fi units, do the following:

1. Insert the Wi-Fi card module into the mini PCI Express slot, and then install the two screws to secure the Wi-Fi card module to the Wi-Fi adapter card.

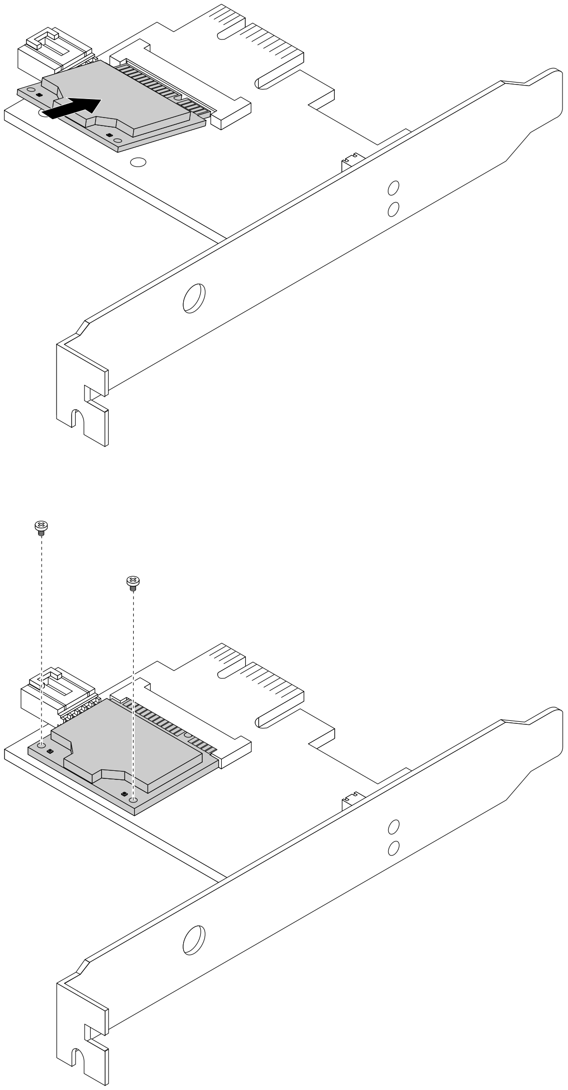


Figure 83. Installing the Wi-Fi card module

2. Connect the front antenna cable and rear antenna cable to the Wi-Fi card module.

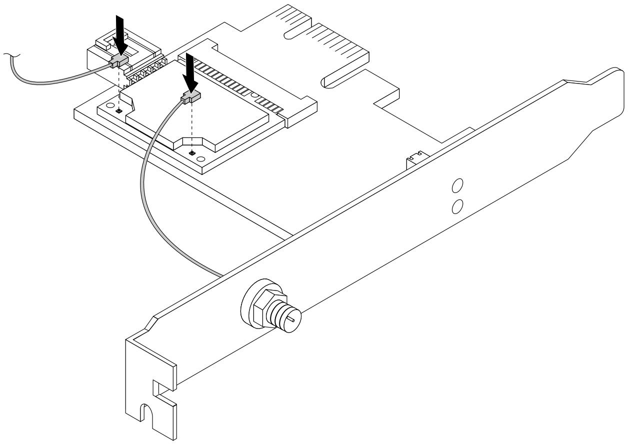


Figure 84. Installing the Wi-Fi antenna cables

3. Install the Wi-Fi adapter card into the PCI Express x1 slot on the system board. See "Locating parts on the system board" on page 74.
4. If the installed Wi-Fi card module supports the Bluetooth function, use a Bluetooth cable to connect the Bluetooth connector on the Wi-Fi adapter card to the front USB connector on the system board.
5. Pivot the card latch to the closed position to secure the Wi-Fi adapter card.

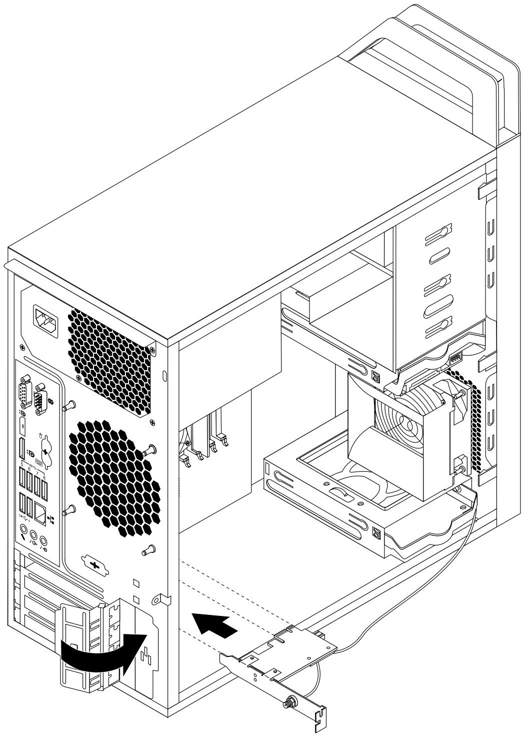


Figure 85. Installing the Wi-Fi adapter card

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 147.

Installing or removing the rear Wi-Fi antenna

Attention:
Do not open your computer or attempt any repair before reading and understanding the "Important safety information" on page 1.

This section provides instructions on how to install or remove the rear Wi-Fi antenna.

Installing the rear Wi-Fi antenna

To install the rear Wi-Fi antenna, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Install the rear Wi-Fi antenna to the rear Wi-Fi antenna cable connector attached on the rear of the computer.
3. Adjust the angle of the rear antenna to lower the risk of breaking the antenna by accident.

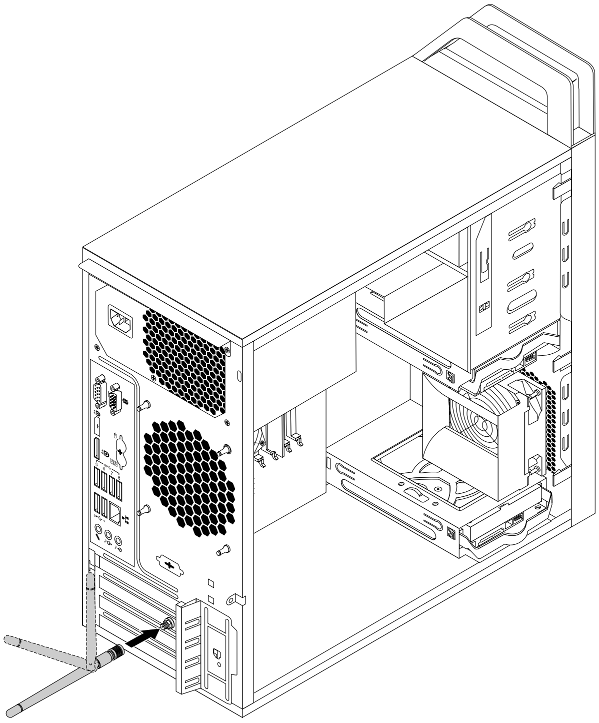


Figure 86. Installing the rear Wi-Fi antenna

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 147.

Removing the rear Wi-Fi antenna

To remove the rear Wi-Fi antenna, do the following:

3. Turn off the computer and disconnect all power cords from electrical outlets.
4. Straighten the rear Wi-Fi antenna so that it can be more easily twisted.
5. Hold the thicker end of the rear Wi-Fi antenna and unscrew the Wi-Fi antenna from the rear of the computer.

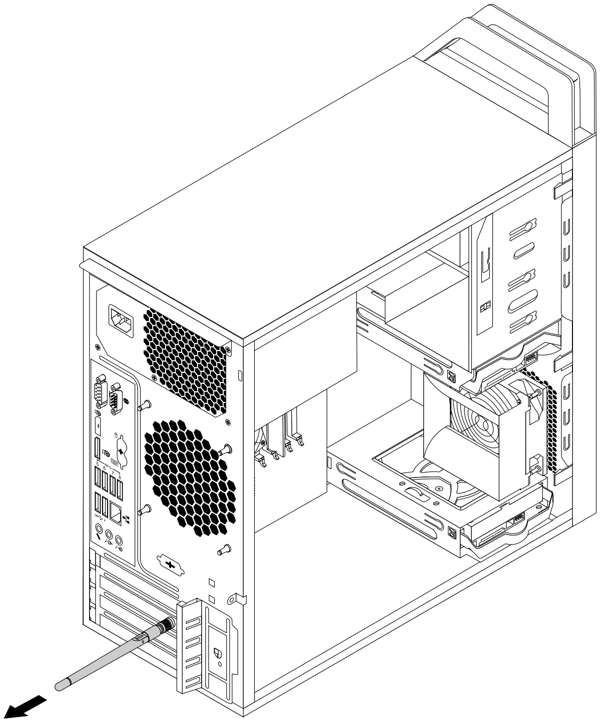


Figure 87. Removing the rear Wi-Fi antenna

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 147.

Installing or removing the front Wi-Fi antenna

Attention:
Do not open your computer or attempt any repair before reading and understanding the "Important safety information" on page 1.

This section provides instructions on how to install or remove the front Wi-Fi antenna.

Installing the front Wi-Fi antenna

To install the front Wi-Fi antenna, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 86.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 87.
4. Peel off the paper that protects the sticker on the front antenna.

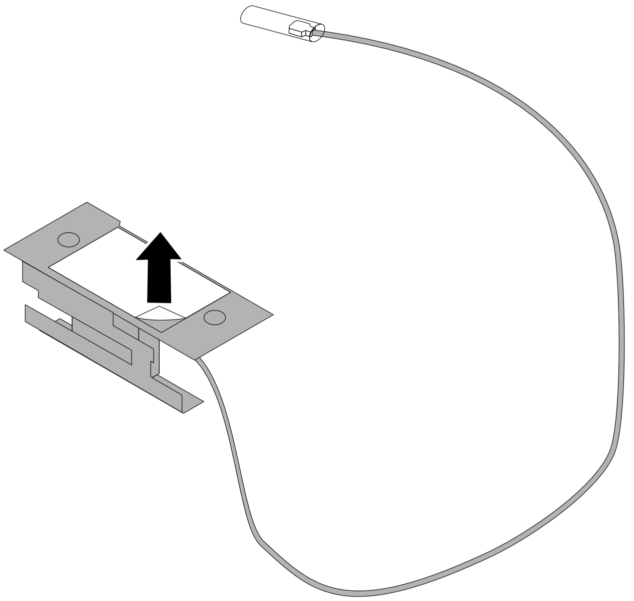


Figure 88. Peeling off the paper that protects the sticker

5. Stick the front antenna to the front panel as shown. Then insert the front antenna cable through the hole in the front panel.

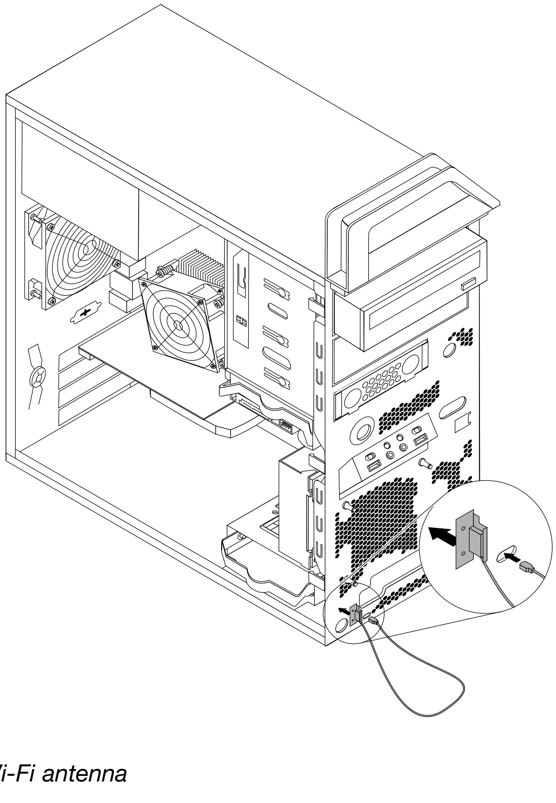


Figure 89. Installing the front Wi-Fi antenna

6. Connect the front antenna cable to the Wi-Fi card module.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 147.

Removing the front Wi-Fi antenna

To remove the front Wi-Fi antenna, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 86.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 87.
4. Disconnect the front antenna cable from the Wi-Fi card module.
5. Remove the front antenna and cable from the front of the computer.

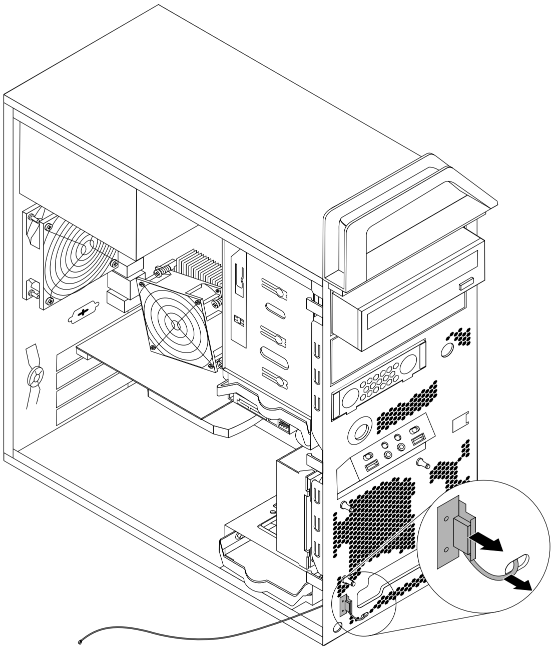


Figure 90. Removing the front Wi-Fi antenna

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 147.

Replacing the keyboard or mouse

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the keyboard or mouse.

To replace the keyboard or mouse, do the following:

1. Disconnect the old keyboard cable or mouse cable from the computer.

2. Connect a new keyboard or mouse to one of the USB connectors on the computer. Depending on where you want to connect the new keyboard or mouse, see "Locating connectors, controls, and indicators on the front of your computer" on page 69 or "Locating connectors on the rear of your computer" on page 70.

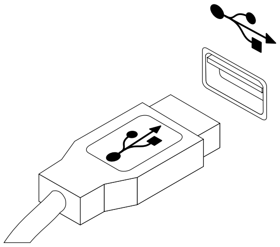


Figure 91. Connecting the USB keyboard or mouse

Completing the parts replacement

After completing the installation or replacement for all parts, you need to reinstall the computer cover and reconnect cables. Depending on the parts you installed or replaced, you might need to confirm the updated information in the Setup Utility program. Refer to Chapter 6 "Using the Setup Utility program" on page 55.

To reinstall the computer cover and reconnect cables to your computer, do the following:

1. Ensure that all components have been reassembled correctly and that no tools or loose screws are left inside your computer. See "Locating major FRUs and CRUs" on page 71 for the locations of various components in your computer.
2. If you have removed the front bezel, reinstall it.
3. Ensure that the cables are routed correctly before reinstalling the computer cover. Keep cables clear of the hinges and sides of the computer chassis to avoid interference with reinstalling the computer cover.

4. Position the computer cover on the chassis so that the rail guides on the bottom of the computer cover engage the rails on the chassis. Then, push the cover to the front of the computer until it snaps into position.

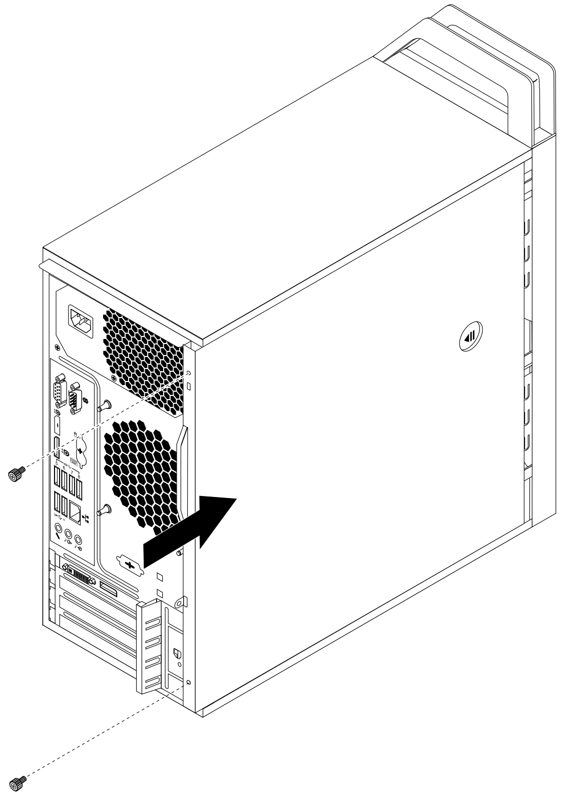


Figure 92. Reinstalling the computer cover

5. Install the screws to secure the computer cover.
6. If there is a padlock available, lock the computer cover.
7. If there is a Kensington-style cable lock available, lock the computer.
8. Reconnect the external cables and power cords to the computer. See “Locating connectors on the rear of your computer” on page 70.
9. To update your configuration, refer to Chapter 6 “Using the Setup Utility program” on page 55.

Note: In most areas of the world, Lenovo requires the return of the defective Field Replaceable Units (FRUs). Information about this will come with the new FRUs or will come a few days after you receive the new FRUs.

Obtaining device drivers

You can obtain device drivers that are not preinstalled in your operating system at http://www.lenovo.com/support. Installation instructions are provided in readme files with the device-driver files.

Chapter 11. Replacing FRUs (machine types: 30A2 and 30A3)

This chapter provides information about the FRU replacement instructions.

Important: Do not open your computer or attempt any repair before reading and understanding the "Important safety information" on page 1.

Note: FRU replacements are to be done only by trained service technicians.

Handling static-sensitive devices

Do not open the static-protective package containing the new part until the defective part has been removed from the computer and you are ready to install the new part. Static electricity, although harmless to you, can seriously damage computer components and parts.

When you handle parts and other computer components, take these precautions to avoid static-electricity damage:

- Limit your movement. Movement can cause static electricity to build up around you.
- Always handle parts and other computer components carefully. Handle PCI cards, memory modules, system boards, and microprocessors by the edges. Never touch any exposed circuitry.
- Prevent others from touching the parts and other computer components.
- Before you replace a new part, touch the static-protective package containing the part to a metal expansion-slot cover or other unpainted metal surface on the computer for at least two seconds. This reduces static electricity from the package and your body.
- When possible, remove the new part from the static-protective packaging, and install it directly in the computer without setting the part down. When this is not possible, place the static-protective package that the part came in on a smooth, level surface and place the part on it.
- Do not place the part on the computer cover or other metal surface.

Installing or replacing hardware

This section provides instructions on how to install or replace hardware for your computer. You can expand the capabilities of your computer and maintain your computer by installing or replacing hardware.

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

Notes:

1. Use only computer parts provided by Lenovo.
2. When installing or replacing an option, use the appropriate instructions in this section along with the instructions that come with the option.

Installing external options

You can connect external options to your computer, such as external speakers, a printer, or a scanner. For some external options, you must install additional software in addition to making the physical connection. When installing an external option, see "Locating connectors, controls, and indicators on the front of your computer" on page 77 and "Locating connectors on the rear of your computer" on page 78 to identify the

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required connector. Then, use the instructions that come with the option to help you make the connection and install any software or device drivers that are required for the option.

Removing the computer cover

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to open the computer cover.

CAUTION:

Before you open the computer cover, turn off the computer and wait several minutes until the computer is cool.

To remove the computer cover, do the following:

1. Remove any media from the drives and turn off all attached devices and the computer.
2. Disconnect all power cords from electrical outlets.
3. Disconnect the power cords, Input/Output cables, and any other cables that are connected to the computer. See “Locating connectors, controls, and indicators on the front of your computer” on page 77 and “Locating connectors on the rear of your computer” on page 78.
4. Remove any locking device that secures the computer cover, such as a padlock or a cable lock.
5. Remove any screws that secure the computer cover.
6. Press the cover-release button on the side of the computer and slide the cover to the rear of the computer to remove the cover.

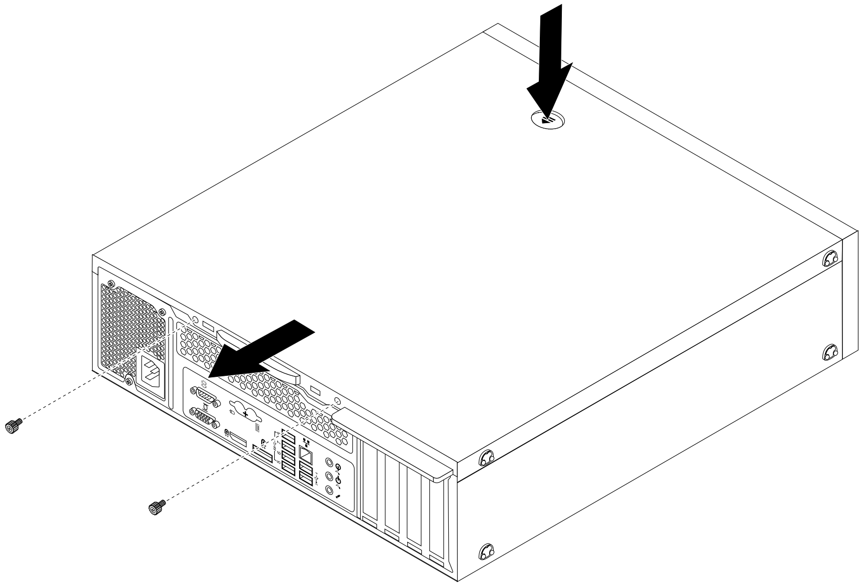


Figure 93. Removing the computer cover

Removing and reinstalling the front bezel

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to remove and reinstall the front bezel.

To remove and reinstall the front bezel, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See "Removing the computer cover" on page 150.
3. Remove the front bezel by releasing the three plastic tabs on the top of the front bezel and pivoting the front bezel outward to remove it from the computer.

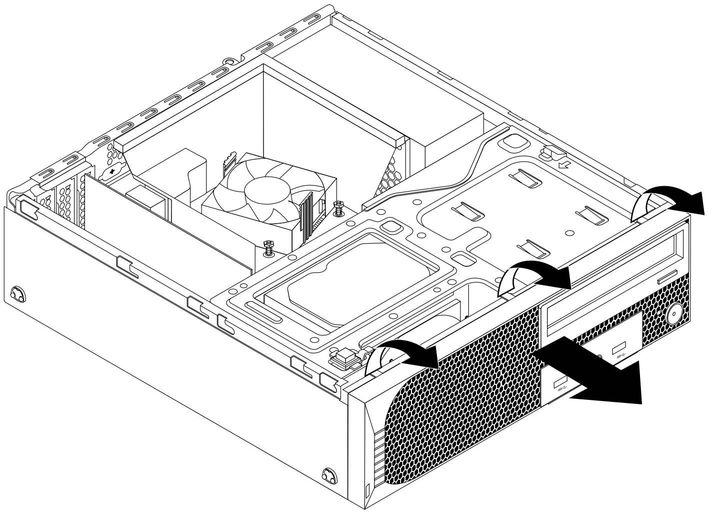


Figure 94. Removing the front bezel

4. To reinstall the front bezel, align the other three plastic tabs on the bottom of the front bezel with the corresponding holes in the chassis, then pivot the front bezel inward until it snaps into position.

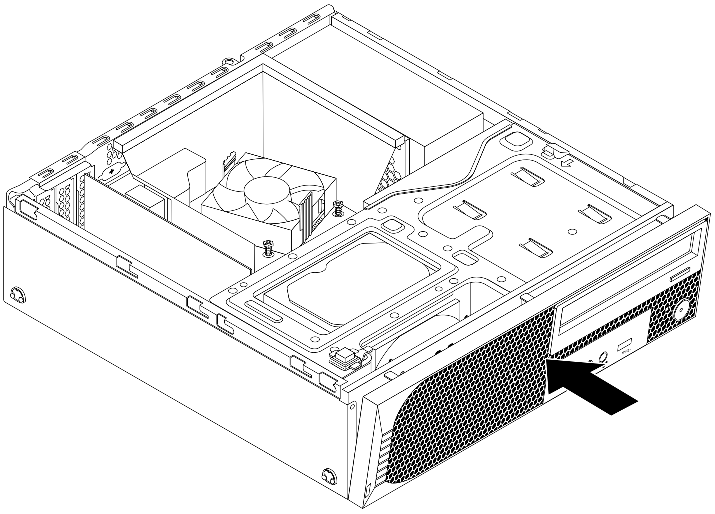


Figure 95. Reinstalling the front bezel

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Accessing the system board components and drives

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to access the system board components and drives.

To access the system board components and drives, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See “Removing the computer cover” on page 150.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 151.
4. Remove the heat sink fan duct. See “Replacing the heat sink and fan assembly” on page 189.
5. Press the release tab and pivot the drive bay assembly upward to access the system board components and the cables.

Installing or replacing a memory module

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to install or replace a memory module.

Your computer has four slots for installing or replacing DDR3 UDIMMs that provide up to a maximum of 32 GB system memory. When installing or replacing a memory module, use 2 GB, 4 GB, or 8 GB DDR3 UDIMMs in any combination up to a maximum of 32 GB.

The following table provides information about the memory module installation rules that you should consider when installing or removing a memory module. The “X” mark indicates the memory slot(s) into which the memory module(s) should be installed in different situations. The numbers 1, 2, 3, and 4 indicate the installation sequence. To locate the memory module slots, see “Locating parts on the system board” on page 82.

UDIMM	DIMM 1	DIMM 2	DIMM 3	DIMM 4
One UDIMM		X		
Two UDIMMs		X, 1		X, 2
Three UDIMMs	X, 3	X, 1		X, 2
Four UDIMMs	X, 3	X, 1	X, 4	X, 2

To install or replace a memory module, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 150.
3. Lay the computer on its side for easier access to the system board.
4. Locate the memory slots. See “Locating parts on the system board” on page 82.
5. Remove any parts that might prevent your access to the memory slots. Depending on your computer model, you might need to remove the PCI Express x16 graphics card for easier access to the memory slots. See “Installing or replacing a PCI card” on page 154.
6. Depending on whether you are installing or replacing a memory module, do one of the following:
   - If you are replacing an old memory module, open the retaining clips and gently pull the memory module out of the memory slot.

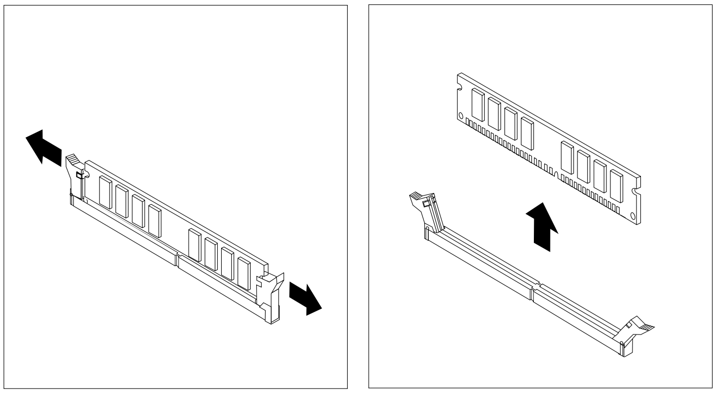


Figure 96. Removing a memory module

- If you are installing a memory module, open the retaining clips of the memory slot into which you want to install the memory module.

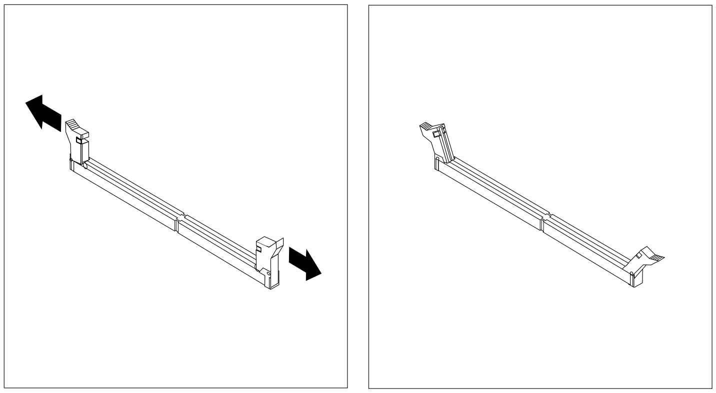


Figure 97. Opening the retaining clips

7. Position the new memory module over the memory slot. Ensure that the notch 1 on the memory module aligns correctly with the slot key 2 on the system board. Push the memory module straight down into the slot until the retaining clips close.

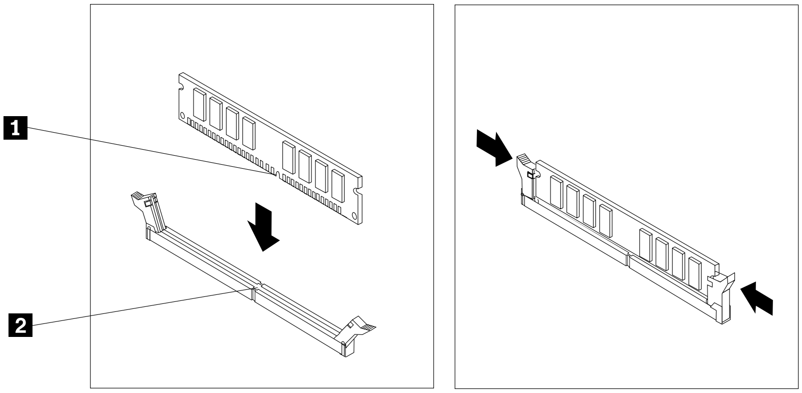


Figure 98. Installing a memory module

8. Reinstall the PCI Express x16 graphics card if you have removed it.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 216.

Installing or replacing a PCI card

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to install or replace a PCI card. Your computer has one PCI card slot, one PCI Express x1 card slot, one PCI Express x16 graphics card slot, and one PCI Express x16 card slot (negotiable link width x4, x1).

To install or replace a PCI card, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 150.
3. Rotate the PCI card retainer to the open position.
4. Depending on whether you are installing or replacing a PCI card, do one of the following:
   - If you are installing a PCI card, remove the appropriate metal slot cover.
   - If you are replacing an old PCI card, grasp the old card that is currently installed and gently pull it out of the slot.

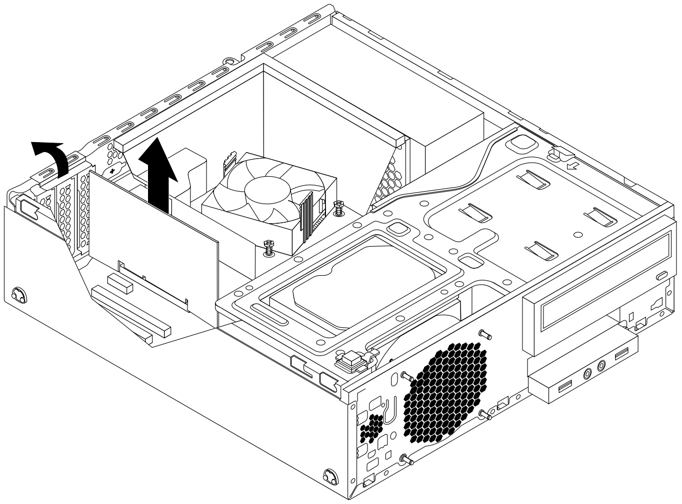


Figure 99. Removing a PCI card

Notes:

a. The card fits tightly into the card slot. If necessary, alternate moving each side of the card a small amount until it is removed from the card slot.

b. If the card is held in place by a retaining latch, disengage the card retaining latch on the PCI card slot. Then grasp the card and gently pull it out of the slot.

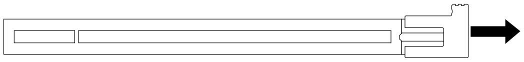


Figure 100. Disengaging the card retaining latch

5. Remove the new PCI card from its static-protective package.

6. Install the new card into the appropriate card slot on the system board and rotate the card retainer to the closed position. See “Locating parts on the system board” on page 82.

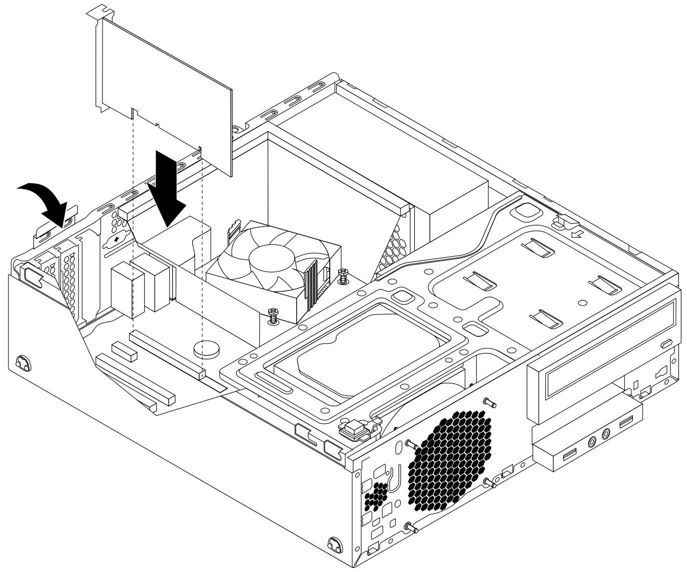


Figure 101. Installing a PCI card

Note: If you are installing a PCI Express x16 graphics card, ensure that the memory slot retaining clips are closed before you install the graphics card.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Installing or replacing the card reader

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to install or replace the card reader.

Note: The card reader is only available in some models. For new installation, see “Installing the card reader” on page 156. For replacement, see “Replacing the card reader” on page 158.

Installing the card reader

To install the card reader, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See “Removing the computer cover” on page 150.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 151.
4. Locate the card reader drive bay. See “Locating internal drives” on page 84.

   Note: You might have to remove the metal cover of the card reader drive bay.

5. Press the release tab **1** as shown and pivot the drive bay assembly upward.

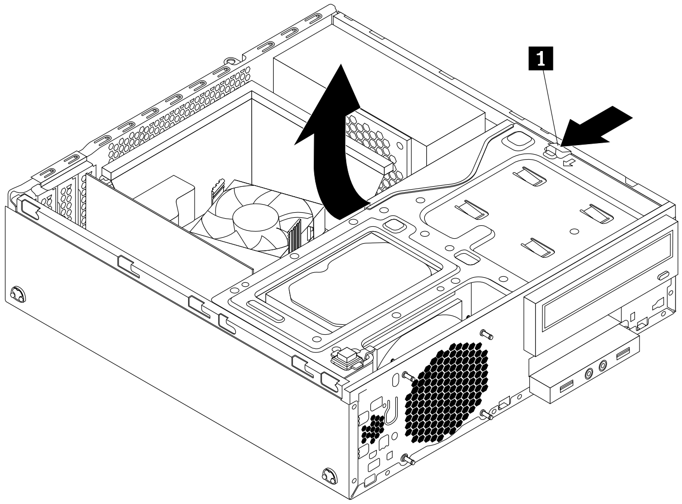


Figure 102. Pivoting the drive bay assembly upward

6. Install the new card reader into the card reader bracket. Then install the two screws to secure the card reader to the bracket.
7. Install the card reader bracket to the chassis. Then push the bracket to the left to align the screw hole in the bracket with the corresponding hole in the chassis.

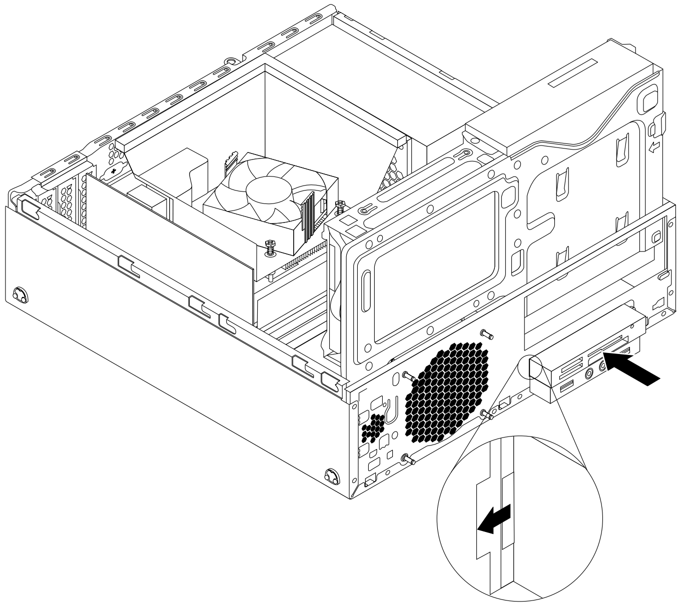


Figure 103. Installing the card reader

8. Install the screw to secure the card reader bracket to the chassis.

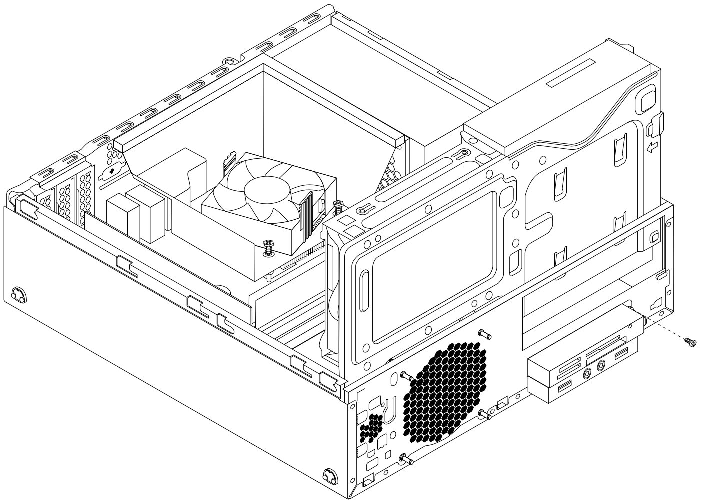


Figure 104. Installing the screw that secures the card reader

9. Connect the card reader cable to Front USB connectors on the system board. See "Locating parts on the system board" on page 82.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 216.

Replacing the card reader

To replace the card reader, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See "Removing the computer cover" on page 150.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 151.
4. Locate the card reader drive bay. See "Locating internal drives" on page 84.

5. Press the release tab **1** as shown and pivot the drive bay assembly upward.

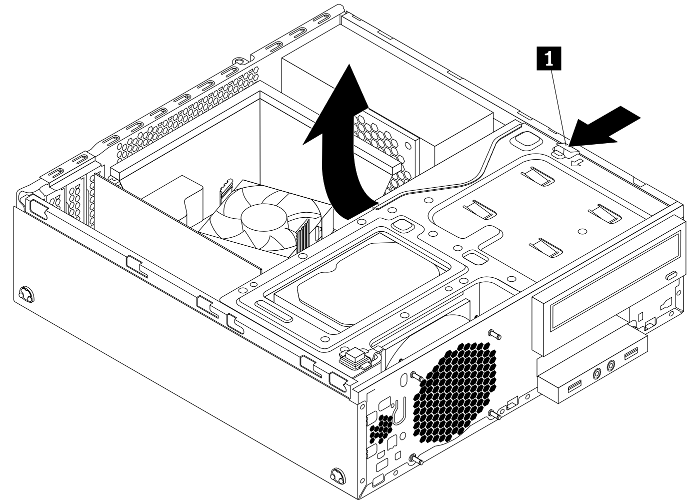


Figure 105. Pivoting the drive bay assembly upward

6. Disconnect the card reader cable from the USB connector on the system board. See "Locating parts on the system board" on page 82.
7. Remove the screw that secures the card reader bracket. Then, remove the card reader bracket from the chassis.

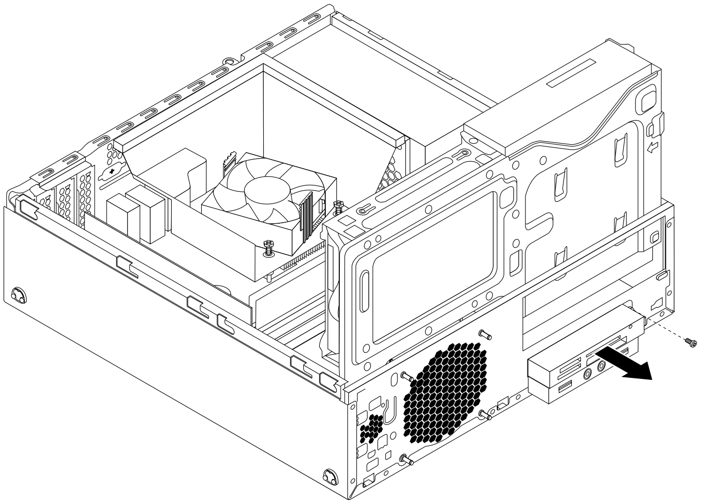


Figure 106. Removing the screw that secures the card reader

8. Remove the two screws that secure the card reader to its bracket. Then remove the failing card reader from the bracket.
9. Install a new card reader into the bracket and install the two screws to secure the card reader to the bracket.

10. Install the card reader bracket to the chassis. Then push the bracket to the left to align the screw hole in the bracket with the corresponding hole in the chassis.

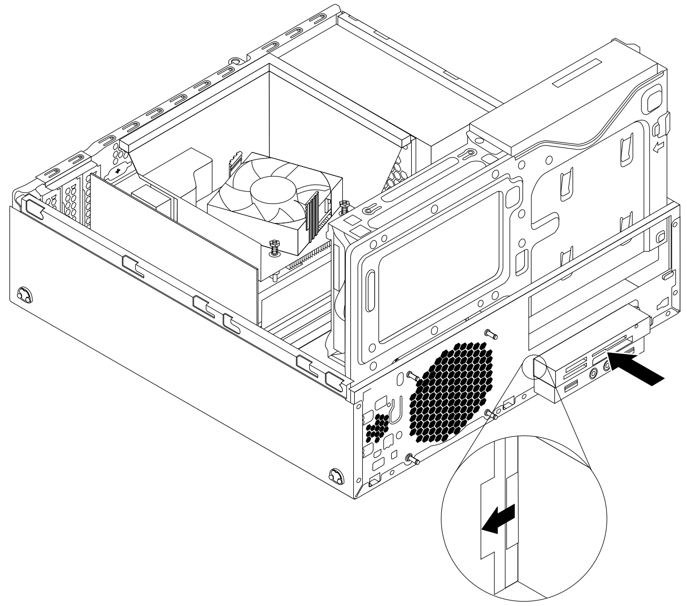


Figure 107. Installing the card reader

11. Install the screw to secure the card reader bracket to the chassis.

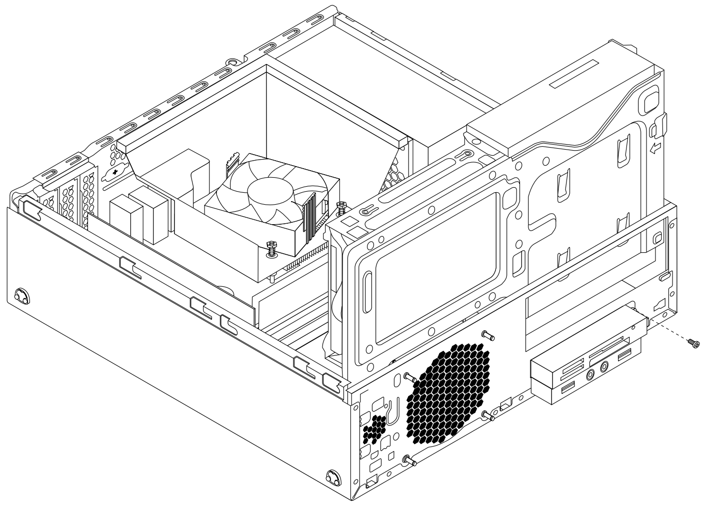


Figure 108. Installing the screw that secures the card reader

12. Reconnect the card reader cable to one of the USB connectors on the system board. See “Locating parts on the system board” on page 82.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Replacing the battery

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

Your computer has a special type of memory that maintains the date, time, and settings for built-in features, such as parallel-port assignments (configuration). A battery keeps this information active when you turn off the computer.

The battery normally requires no charging or maintenance throughout its life; however, no battery lasts forever. If the battery fails, the date, time, and configuration information (including passwords) are lost. An error message is displayed when you turn on the computer.

Refer to the "Lithium battery notice" in the *Safety, Warranty, and Setup Guide* for information about replacing and disposing of the battery.

To replace the battery, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 150.
3. Remove the heat sink fan duct. See "Replacing the heat sink and fan assembly" on page 189.
4. Depending on your computer model, you might need to remove the PCI Express x 16 graphics card for easier access to the battery. See "Installing or replacing a PCI card" on page 154.
5. Remove the old battery.

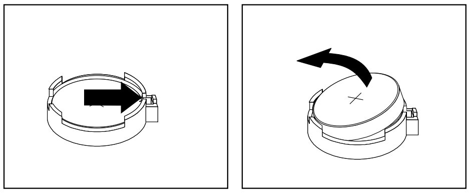


Figure 109. Removing the old battery

6. Install a new battery.

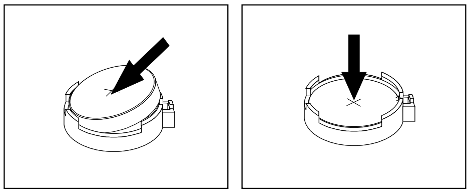


Figure 110. Installing a new battery

7. Reinstall the PCI Express x 16 graphics card if you had removed it. See "Installing or replacing a PCI card" on page 154.
8. Reinstall the heat sink fan duct. See "Replacing the heat sink and fan assembly" on page 189.
9. Reinstall the computer cover and reconnect the cables. See "Completing the parts replacement" on page 216.

Note: When the computer is turned on for the first time after replacing the battery, an error message might be displayed. This is normal after replacing the battery.

10. Turn on the computer and all attached devices.
11. Use the Setup Utility program to set the date, time, and any passwords. See Chapter 6 “Using the Setup Utility program” on page 55.

Installing the solid-state drive

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to install the 2.5-inch solid-state drive.

To install the solid-state drive, do the following:

1. Install the solid-state drive into the storage converter. Then, install the four screws to secure the solid-state drive to the storage converter.

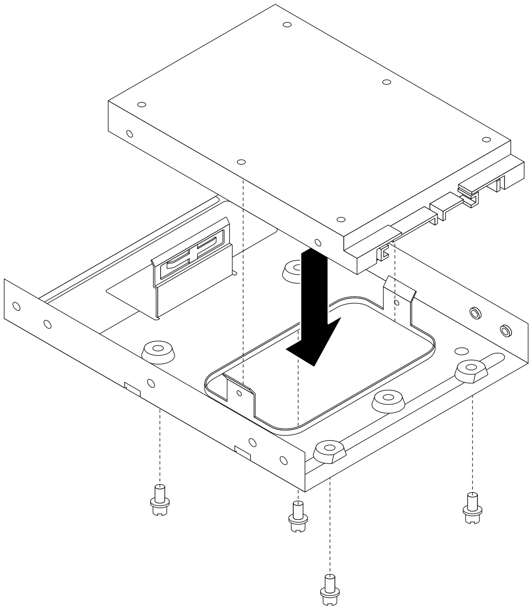


Figure 111. Installing the solid-state drive into the adapter

2. To install the solid-state drive with the storage converter into the 3.5-inch hard disk drive bracket, flex the bracket and align pin **1**, pin **2**, pin **3**, and pin **4** on the bracket with the corresponding holes in the storage converter.

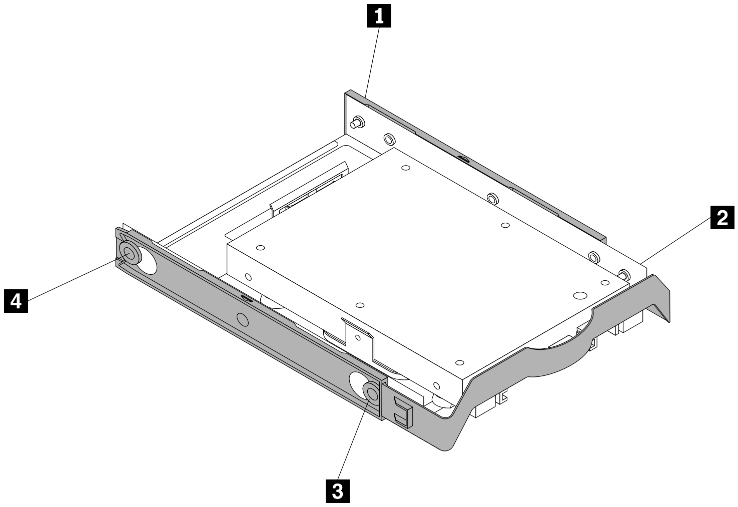


Figure 112. Installing the solid-state drive with the storage converter into the hard disk drive bracket

3. Connect the signal cable and the power cable to the solid-state drive.
4. Install the solid-state drive into the desired hard disk drive bay. See "Replacing the hard disk drive" on page 169.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 216.

Installing or replacing the mSATA solid-state drive

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to install or replace the mSATA solid-state drive.

Note: The mSATA solid-state drive is only available in some models. For new installation, see "Installing the mSATA solid-state drive" on page 163. For replacement, see "Replacing the mSATA solid-state drive" on page 165.

Installing the mSATA solid-state drive

To install the mSATA solid-state drive, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See "Removing the computer cover" on page 150.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 151.
4. Locate the card reader drive bay. See "Locating internal drives" on page 84.

   Note: You might have to remove the metal cover of the card reader drive bay.

5. Press the release tab **1** as shown and pivot the drive bay assembly upward.

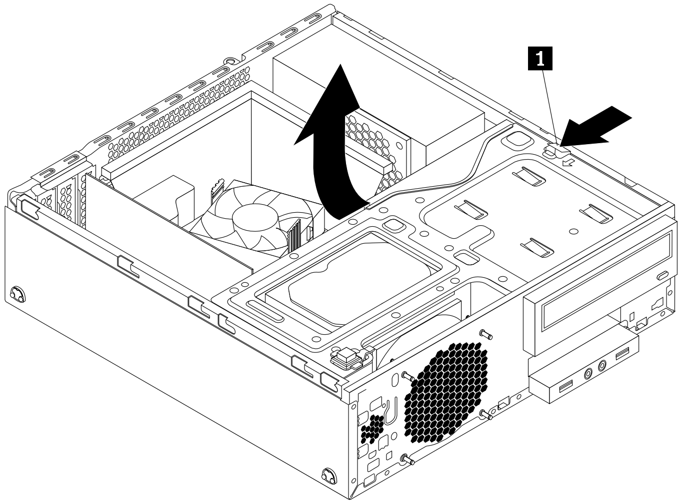


Figure 113. Pivoting the drive bay assembly upward

6. Insert the mSATA solid-state drive into the mini PCI Express slot on the storage converter, and then press the mSATA solid-state drive downward.

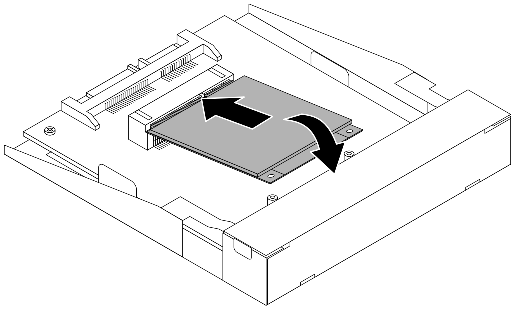


Figure 114. Installing the mSATA solid state drive into the storage converter

7. Install the two screws to secure the mSATA solid-state drive to the storage converter.

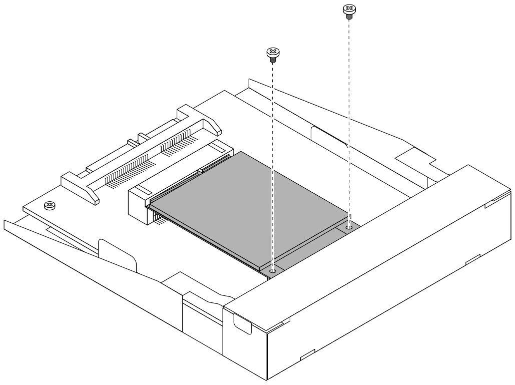


Figure 115. Installing the screws that secure the mSATA solid state drive

8. Insert the mSATA solid-state drive storage converter to the chassis and push the converter to the left to align the screw hole in the converter with the corresponding hole in the chassis. Then install the screw to secure the mSATA solid-state drive storage converter to the chassis.

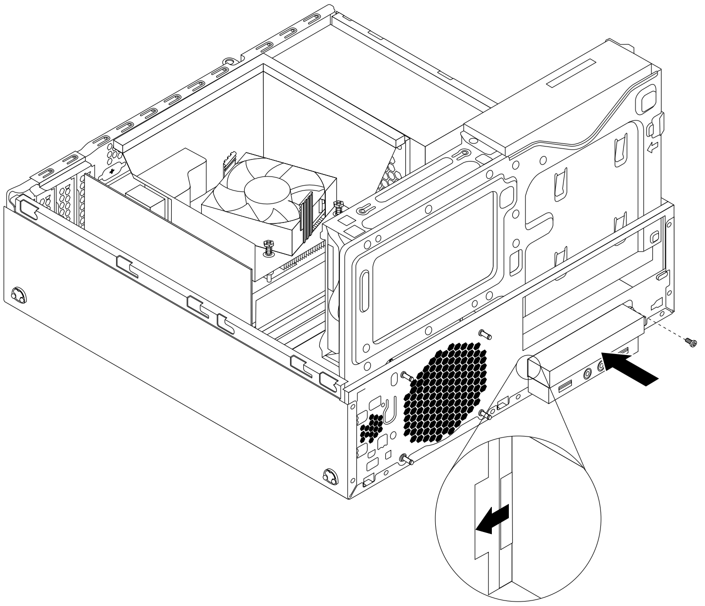


Figure 116. Installing the mSATA solid-state drive

9. Connect the signal cable and the power cable to the mSATA solid-state drive.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 216.

Replacing the mSATA solid-state drive

To replace the mSATA solid-state drive, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See "Removing the computer cover" on page 86.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 87.
4. Locate the card reader drive bay. See "Locating internal drives" on page 76.

5. Press the release tab **1** as shown and pivot the drive bay assembly upward.

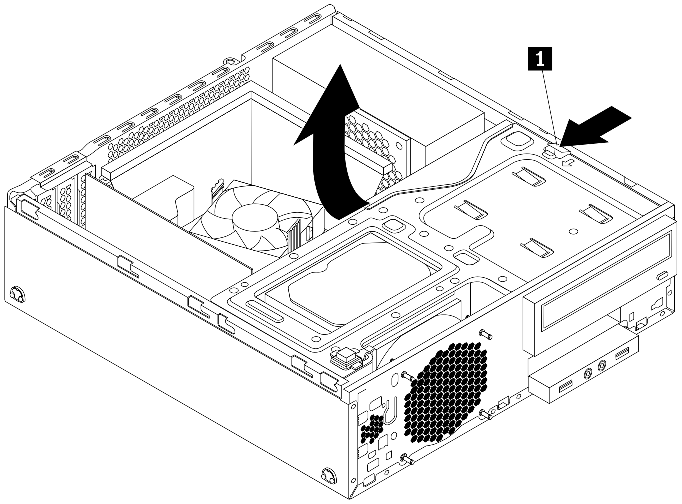


Figure 117. Pivoting the drive bay assembly upward

6. Disconnect the card reader cable from the USB connector on the system board. See "Locating parts on the system board" on page 74.
7. Disconnect the signal cable and power cable from the mSATA solid state drive.
8. Remove the screw that secures the mSATA solid-state drive storage converter. Then remove the mSATA solid-state drive storage converter from the chassis.

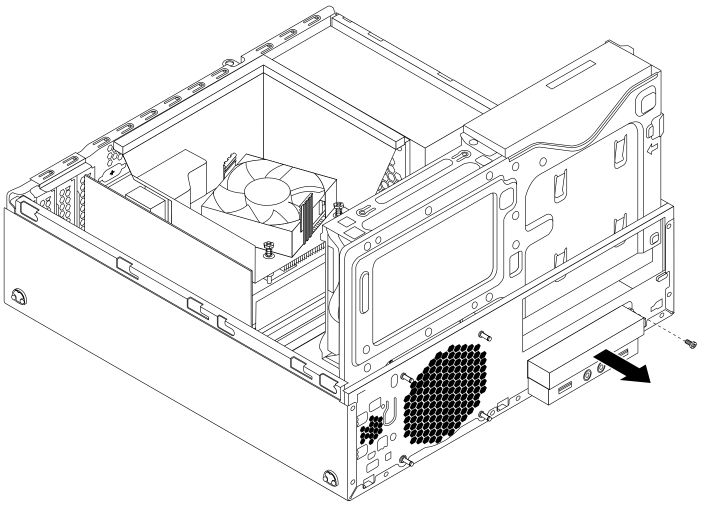


Figure 118. Removing the mSATA solid-state drive storage converter

9. Remove the two screws that secure the mSATA solid-state drive from the storage converter.

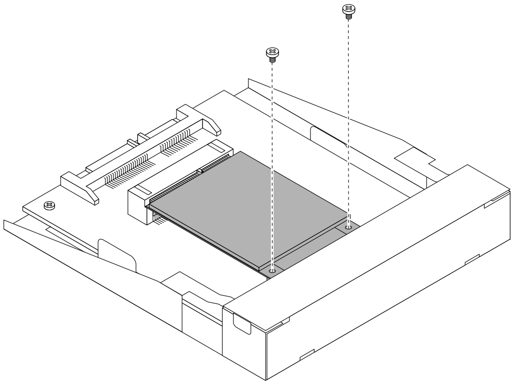


Figure 119. Removing the screws that secure the mSATA solid state drive

10. Remove the mSATA solid-state drive from the mini PCI Express slot on the storage converter.

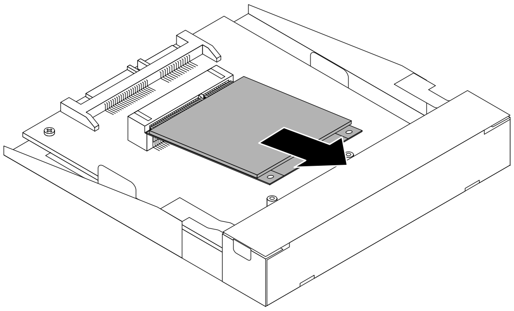


Figure 120. Removing the mSATA solid state drive

11. To install a new mSATA solid-state drive, insert the mSATA solid-state drive into the mini PCI Express slot on the storage converter, and then press the mSATA solid-state drive downward.

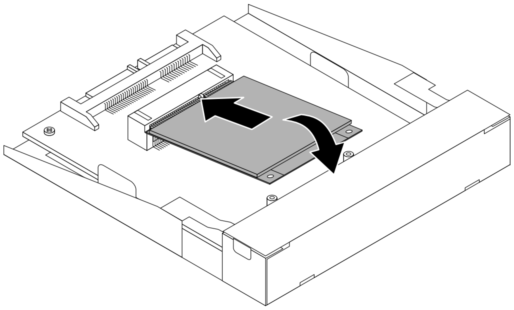


Figure 121. Installing the mSATA solid state drive into the storage converter

12. Install the two screws to secure the mSATA solid-state drive to the storage converter.

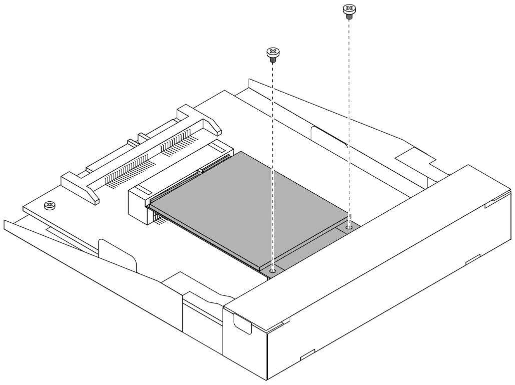


Figure 122. Installing the screws that secure the mSATA solid state drive

13. Insert the mSATA solid-state drive storage converter to the chassis and push the converter to the left to align the screw hole in the converter with the corresponding hole in the chassis. Then install the screw to secure the mSATA solid-state drive storage converter to the chassis.

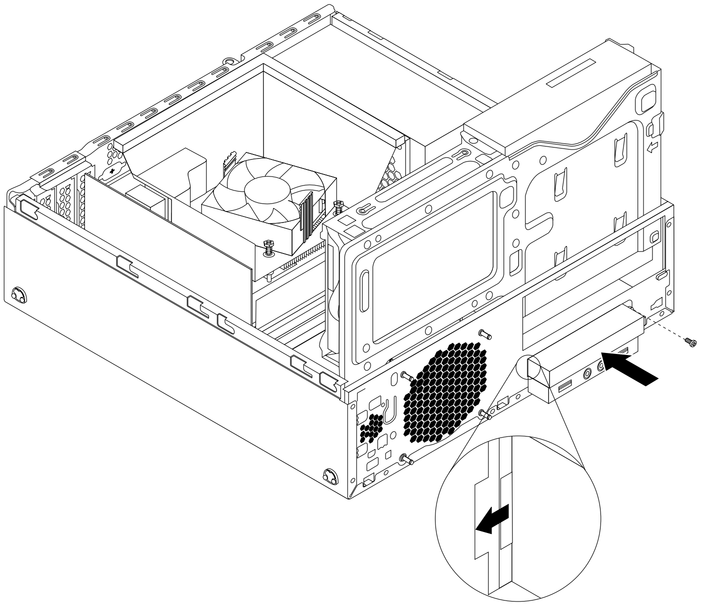


Figure 123. Installing the mSATA solid-state drive

14. Connect the signal cable and the power cable to the mSATA solid-state drive.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Replacing the hard disk drive

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to replace the primary hard disk drive.

Note: This section also applies to computer models with a 2.5-inch solid-state drive.

To replace the primary hard disk drive, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 150.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 151.
4. Press the release tab **1** as shown and pivot the drive bay assembly upward.

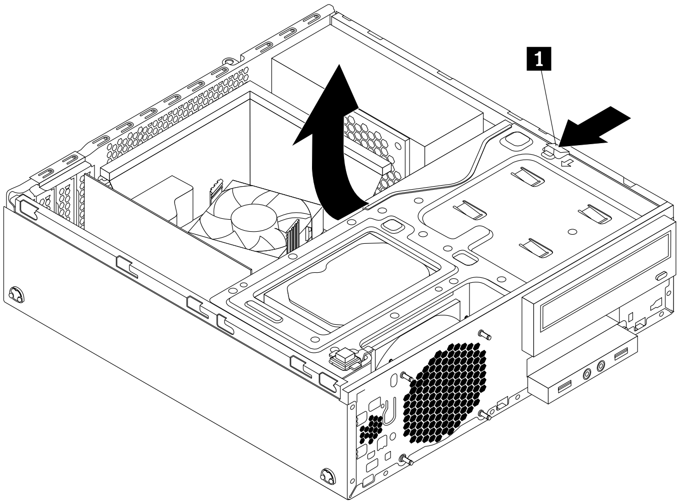


Figure 124. Pivoting the drive bay assembly upward

5. Disconnect the signal cable and the power cable from the hard disk drive.

6. Pull the blue handle to slide the hard disk drive out of the drive cage.

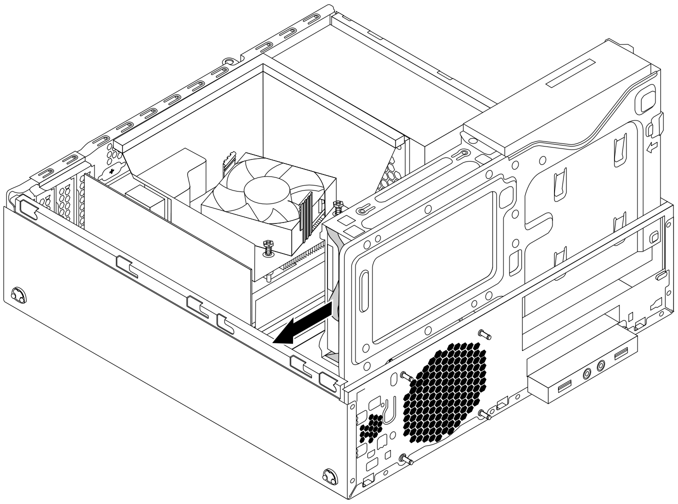


Figure 125. Removing the hard disk drive

7. Flex the sides of the blue bracket to remove the hard disk drive from the bracket.
8. To install a new hard disk drive into the blue bracket, flex the bracket and align pin **1**, pin **2**, pin **3**, and pin **4** on the bracket with the corresponding holes in the hard disk drive. Do not touch the circuit board **5** on the bottom of the hard disk drive.

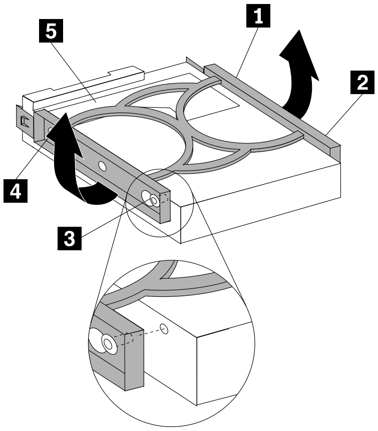


Figure 126. Installing the hard disk drive into the bracket

9. Slide the new hard disk drive into the drive cage until it snaps into position.

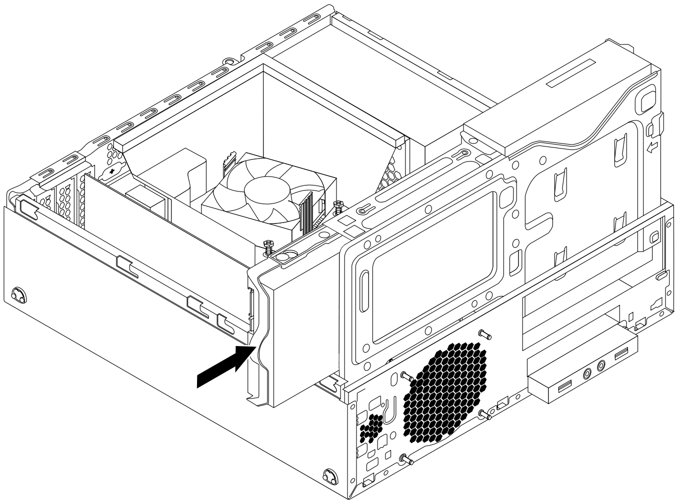


Figure 127. Installing the hard disk drive

10. Connect the signal cable and the power cable to the new hard disk drive.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Installing or replacing the secondary hard disk drive

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to install or replace the secondary hard disk drive.

Note: The secondary hard disk drive is only available in some models. For new installation, see “Installing the secondary hard disk drive” on page 171. For replacement, see “Replacing the secondary hard disk drive” on page 175.

Installing the secondary hard disk drive

To install the secondary hard disk drive, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See “Removing the computer cover” on page 150.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 151.
4. Press the release tab **1** as shown and pivot the drive bay assembly upward.

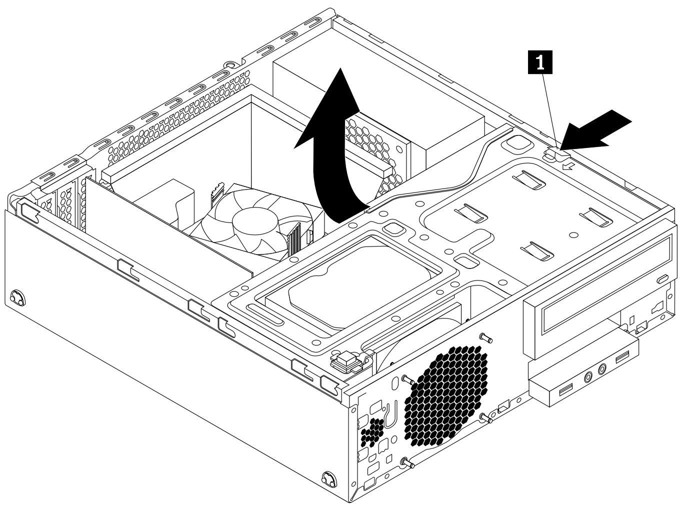


Figure 128. Pivoting the drive bay assembly upward

5. Remove the cable clip on the bottom of the primary hard disk drive bay as shown.

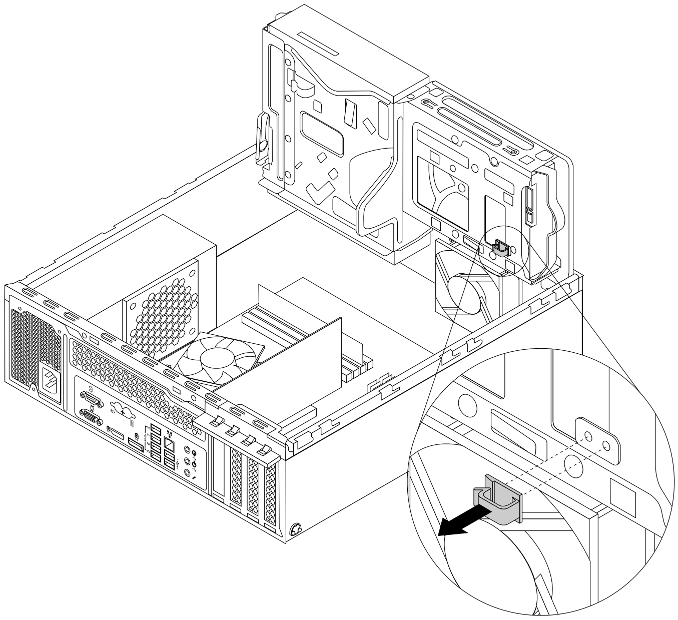


Figure 129. Removing the cable clip

6. Align the four holes in the secondary hard disk drive bracket with the corresponding four tabs on the bottom of the primary hard disk drive bay as shown. Then, position the bracket onto the bottom of the primary hard disk drive bay so that the tabs on the bay pass through the holes in the bracket.

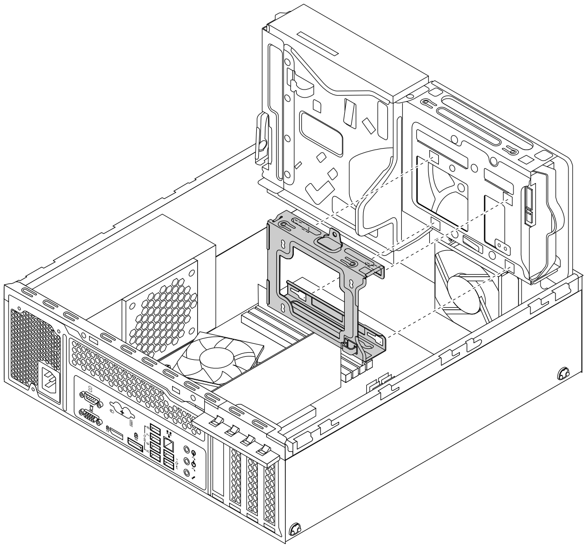


Figure 130. Positioning the bracket onto the bottom of the primary hard disk drive bay

7. Slide the secondary hard disk drive bracket to the left of the chassis until it snaps into position and the screw hole **1** in the bracket is aligned with the screw hole in the bay **2**.

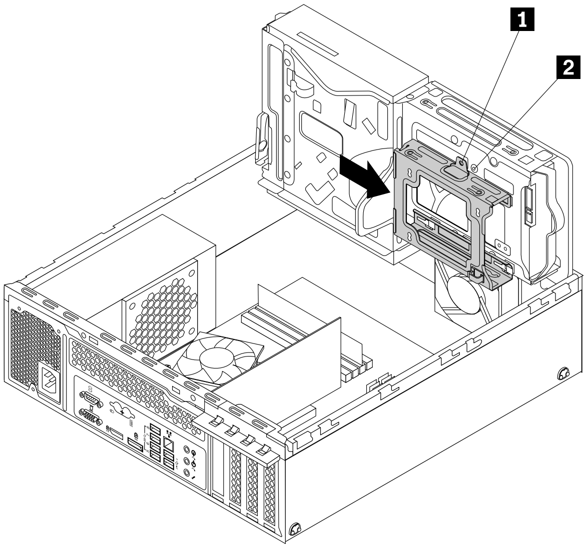


Figure 131. Installing the secondary hard disk drive bracket

8. Install the screw to secure the secondary hard disk drive bracket to the chassis.

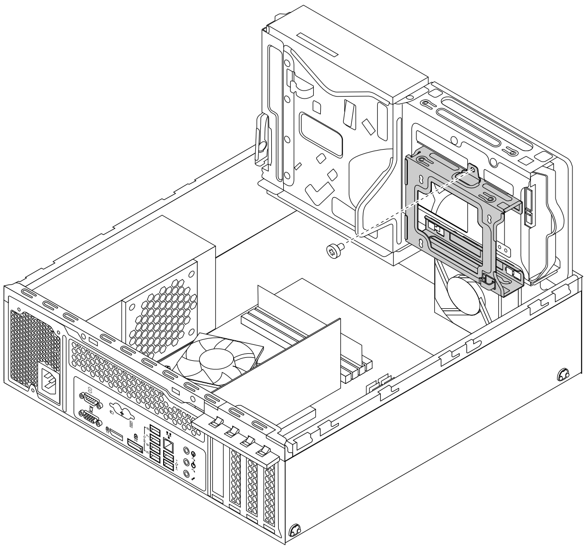


Figure 132. Installing the screw to secure the secondary hard disk drive bracket

9. To install a new hard disk drive into the blue bracket, flex the bracket and align pin **1**, pin **2**, pin **3**, and pin **4** on the bracket with the corresponding holes in the hard disk drive. Do not touch the circuit board **5** on the bottom of the hard disk drive.

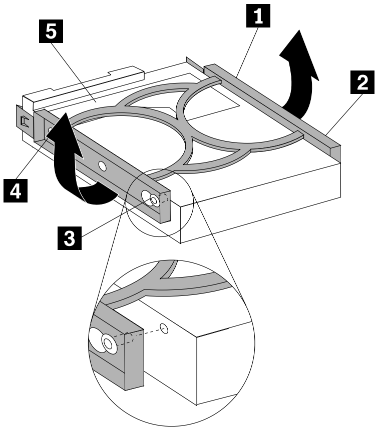


Figure 133. Installing the hard disk drive into the bracket

10. Slide the new secondary hard disk drive into the bracket until it snaps into position.

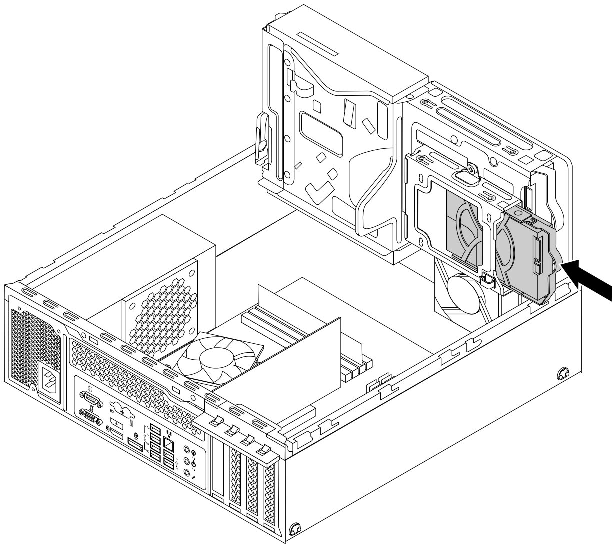


Figure 134. Installing the secondary hard disk drive

11. Connect the signal cable and the power cable to the new secondary hard disk drive.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Replacing the secondary hard disk drive

This section provides instructions on how to replace the secondary hard disk drive.

To replace the secondary hard disk drive, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 150.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 151.
4. Press the release tab **1** as shown and pivot the drive bay assembly upward.

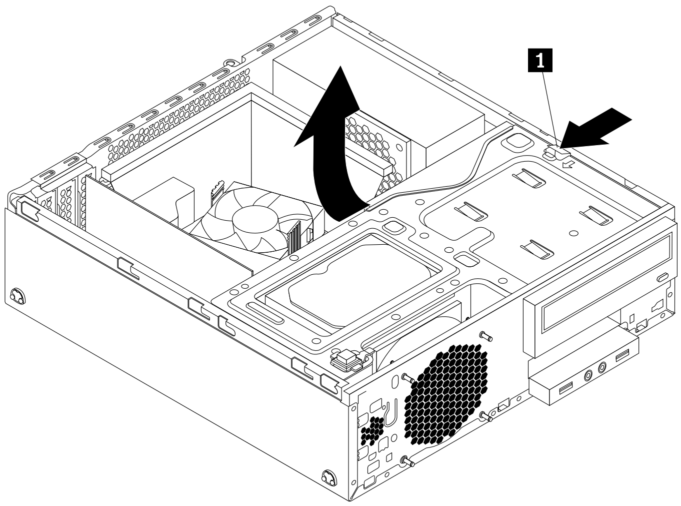


Figure 135. Pivoting the drive bay assembly upward

5. Locate the secondary hard disk drive bay. See “Locating internal drives” on page 84.
6. Disconnect the signal cable and the power cable from the primary hard disk drive and secondary hard disk drive.
7. Pull the blue handle to slide the secondary hard disk drive from the bracket.

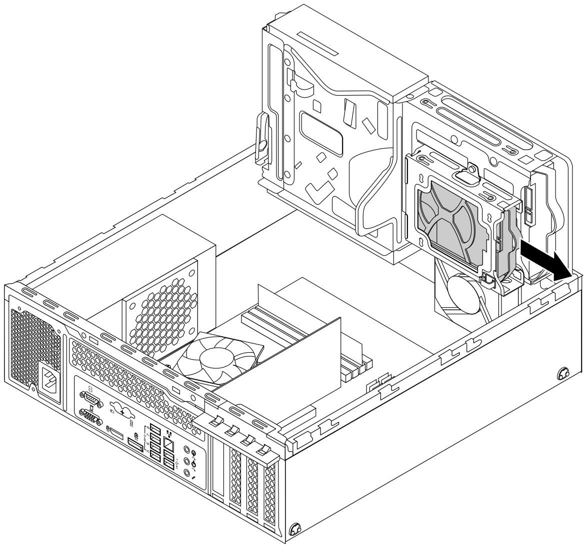


Figure 136. Removing the secondary hard disk drive

8. To install a new hard disk drive into the blue bracket, flex the bracket and align pin **1**, pin **2**, pin **3**, and pin **4** on the bracket with the corresponding holes in the hard disk drive. Do not touch the circuit board **5** on the bottom of the hard disk drive.

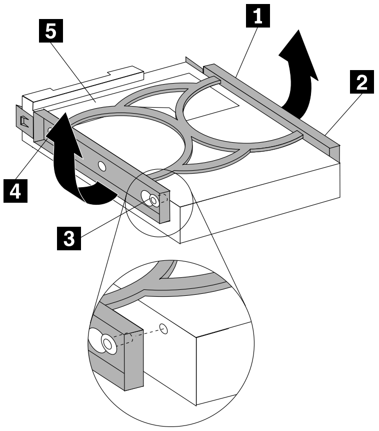


Figure 137. Installing the hard disk drive into the bracket

9. Slide the new secondary hard disk drive into the bracket until it snaps into position.

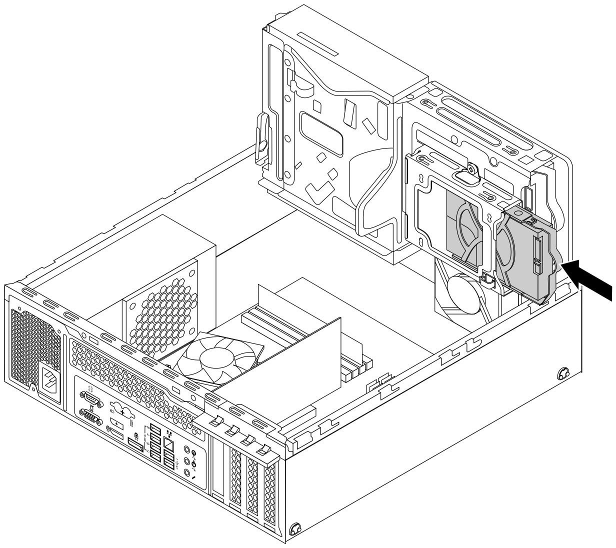


Figure 138. Installing the secondary hard disk drive

10. Connect the signal cable and the power cable to the primary hard disk drive and secondary hard disk drive.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Replacing the Wi-Fi units

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to replace the Wi-Fi units. The Wi-Fi units include a Wi-Fi adapter card, a Wi-Fi card module, and a rear Wi-Fi antenna cable.

Replacing the Wi-Fi units involves the following operations:

- "Removing the Wi-Fi adapter card" on page 178
- "Removing the Wi-Fi card module" on page 179
- "Installing the Wi-Fi units" on page 180

Removing the Wi-Fi adapter card

To remove a Wi-Fi adapter card, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 150.
3. If your computer comes with a Wi-Fi card module that supports the Bluetooth function, disconnect the Bluetooth cable from the Wi-Fi adapter card.

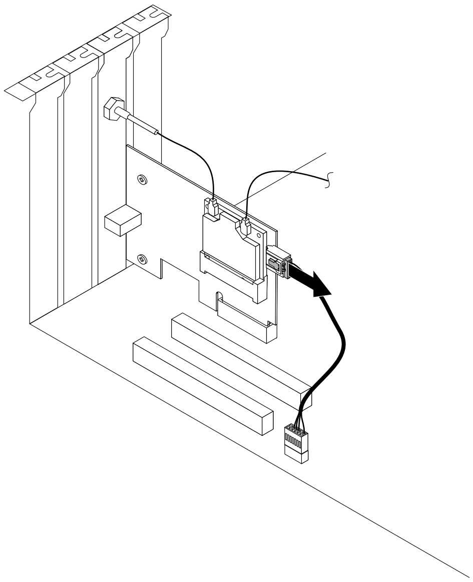


Figure 139. Disconnecting the Bluetooth cable

Note: The Bluetooth cable connects the Bluetooth connector on the Wi-Fi adapter card to the front USB connector on the system board to support the Bluetooth function.

4. Rotate the PCI card retainer to the open position.

5. Grasp the Wi-Fi adapter card that is currently installed and gently pull it out of the slot.

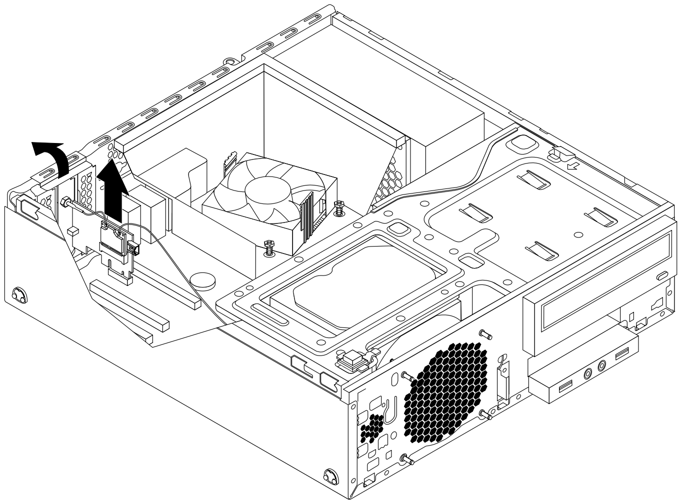


Figure 140. Removing the Wi-Fi adapter card

Note: The card fits tightly into the card slot. If necessary, alternate moving each side of the card a small amount until it is removed from the card slot.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Removing the Wi-Fi card module

To remove the Wi-Fi card module, do the following:

1. Remove the Wi-Fi adapter card from the computer, and then disconnect the front and rear Wi-Fi antenna cables from the Wi-Fi card module.

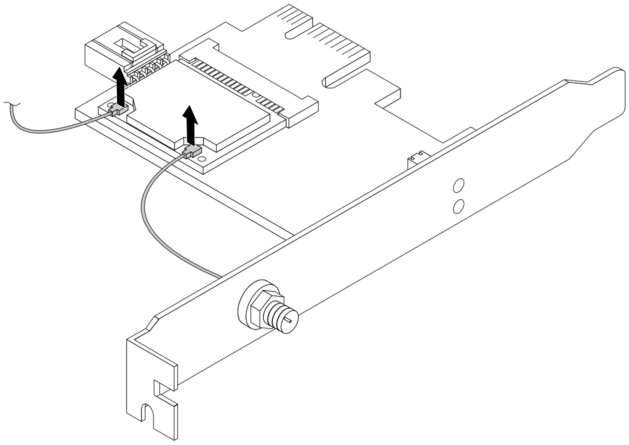


Figure 141. Removing the Wi-Fi antenna cables

2. Remove the two screws that secure the Wi-Fi card module to the Wi-Fi adapter card.

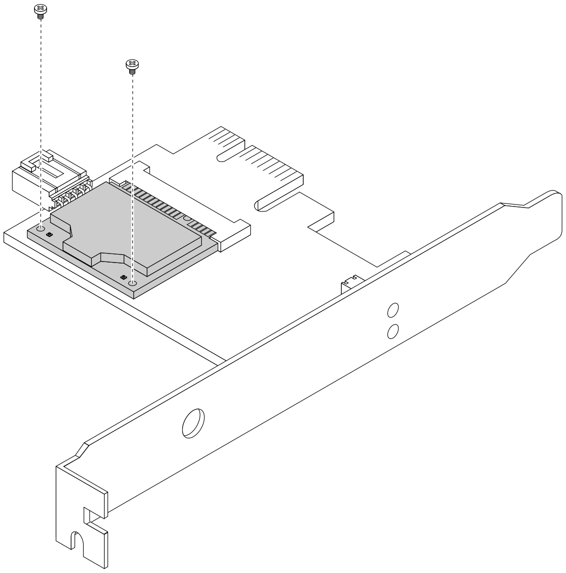


Figure 142. Removing the screws that secure the Wi-Fi card module

3. Pull the Wi-Fi card module out of the mini PCI Express slot to remove it from the Wi-Fi adapter card.

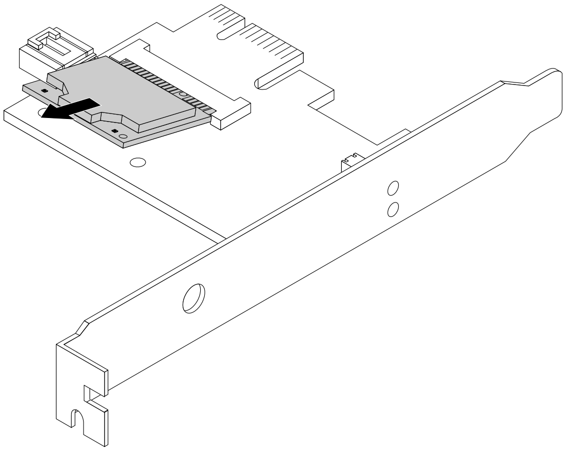


Figure 143. Removing the Wi-Fi card module

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Installing the Wi-Fi units

To install the Wi-Fi units, do the following:

1. Insert the Wi-Fi card module into the mini PCI Express slot, and then install the two screws to secure the Wi-Fi card module to the Wi-Fi adapter card.

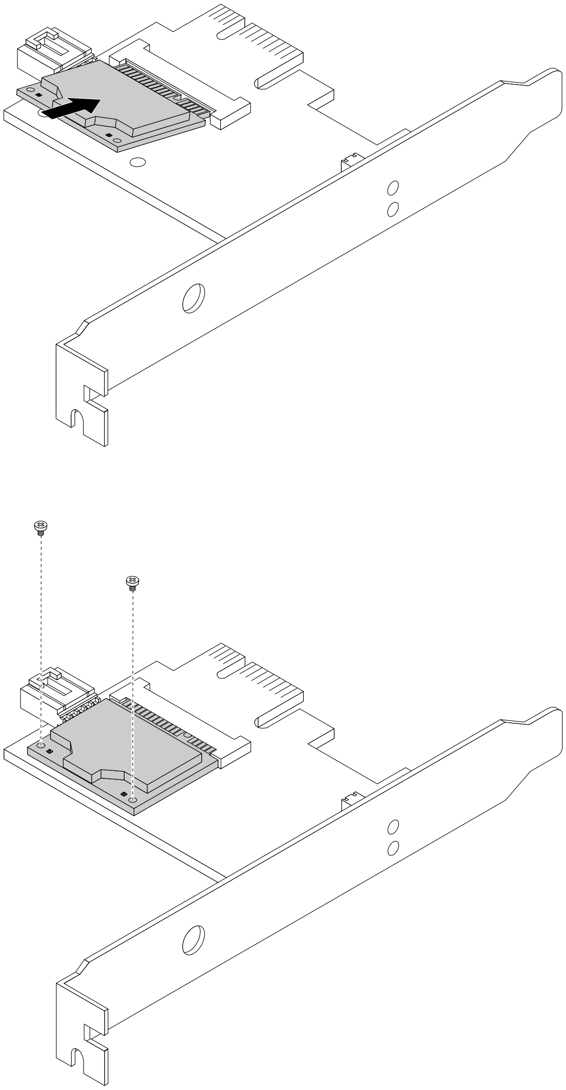


Figure 144. Installing the Wi-Fi card module

2. Connect the front antenna cable and rear antenna cable to the Wi-Fi card module.

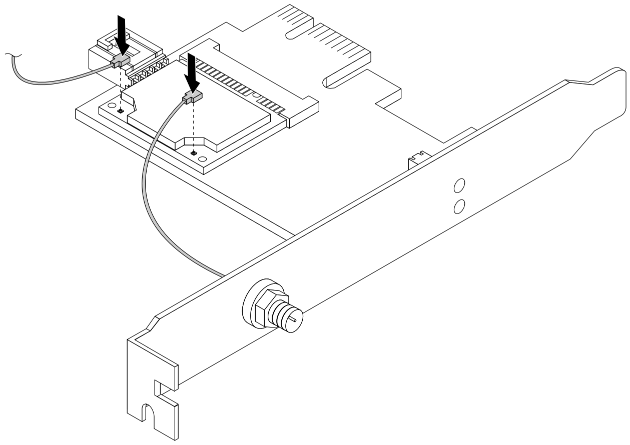


Figure 145. Installing the Wi-Fi antenna cables

3. Install the Wi-Fi adapter card into the PCI Express x1 slot on the system board. See "Locating parts on the system board" on page 82.
4. If the installed Wi-Fi card module supports the Bluetooth function, use a Bluetooth cable to connect the Bluetooth connector on the Wi-Fi adapter card to the front USB connector on the system board.
5. Pivot the card latch to the closed position to secure the Wi-Fi adapter card.

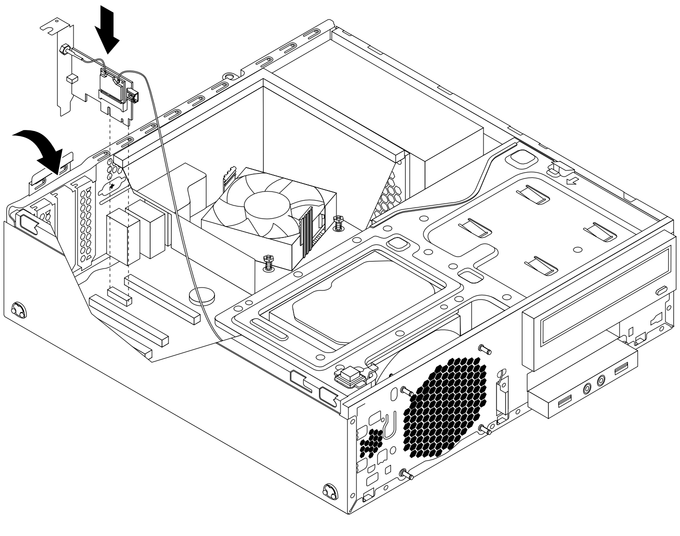


Figure 146. Installing the Wi-Fi adapter card

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 216.

Installing or removing the rear Wi-Fi antenna

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to install or remove the rear Wi-Fi antenna.

Installing the rear Wi-Fi antenna

To install the rear Wi-Fi antenna, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Install the rear Wi-Fi antenna to the rear Wi-Fi antenna cable connector attached on the rear of the computer.
3. Adjust the angle of the rear antenna to lower the risk of breaking the antenna by accident.

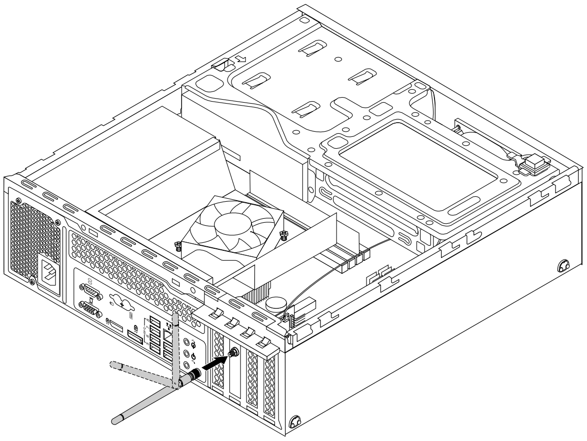


Figure 147. Installing the rear Wi-Fi antenna

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 216.

Removing the rear Wi-Fi antenna

To remove the rear Wi-Fi antenna, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Straighten the rear Wi-Fi antenna so that it can be more easily twisted.

3. Hold the thicker end of the rear Wi-Fi antenna and unscrew the Wi-Fi antenna from the rear of the computer.

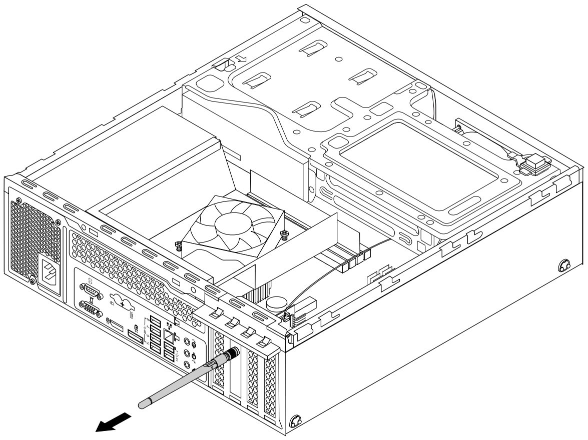


Figure 148. Removing the rear Wi-Fi antenna

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Installing or removing the front Wi-Fi antenna

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to install or remove the front Wi-Fi antenna.

Installing the front Wi-Fi antenna

To install the front Wi-Fi antenna, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 150.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 151.

4. Press the release tab **1** as shown and pivot the drive bay assembly upward.

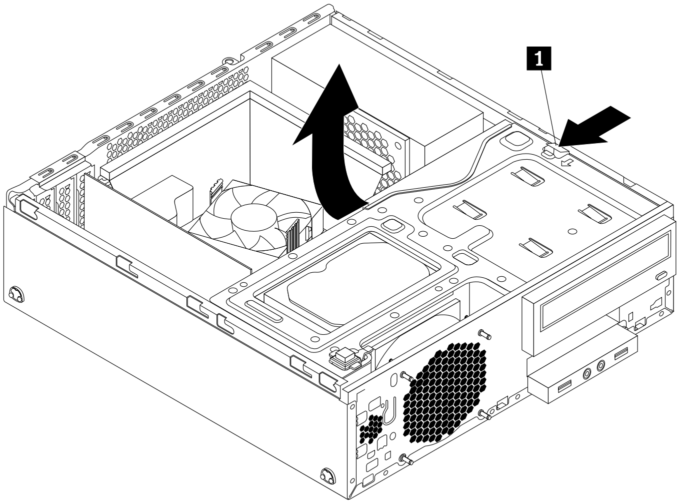


Figure 149. Pivoting the drive bay assembly upward

5. Peel off the paper that protects the sticker on the front antenna.

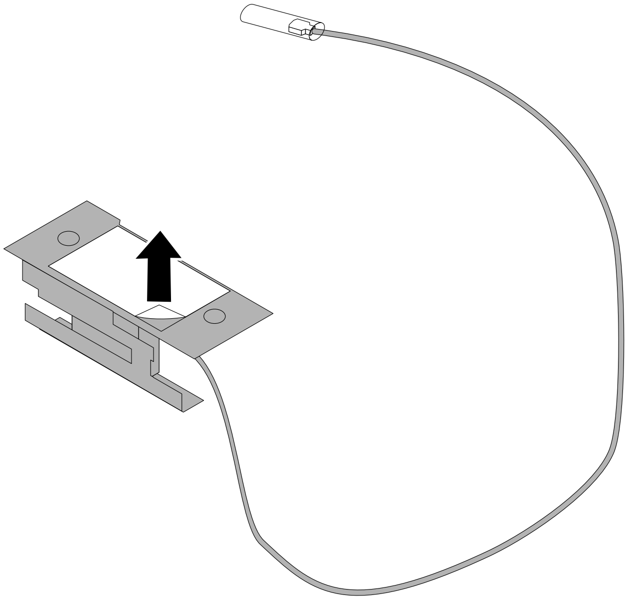


Figure 150. Peeling off the paper that protects the sticker

6. Stick the front antenna to the front panel as shown. Then insert the front antenna cable through the hole in the front panel.

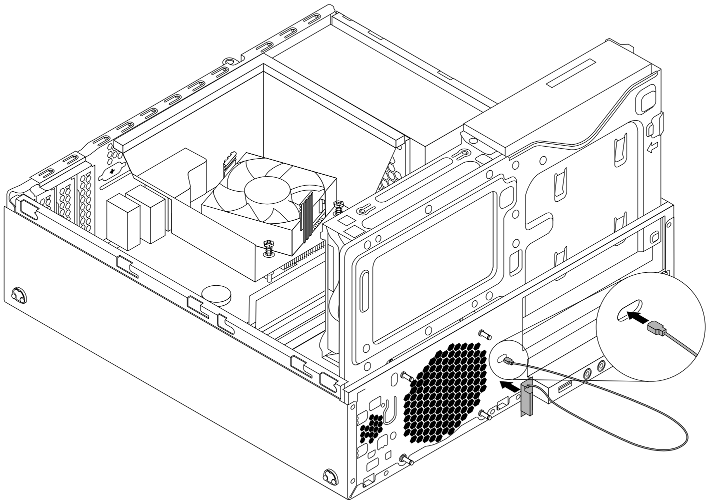


Figure 151. Installing the front Wi-Fi antenna

7. Connect the front antenna cable to the Wi-Fi card module.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 216.

Removing the front Wi-Fi antenna

To remove the front Wi-Fi antenna, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 150.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 151.
4. Press the release tab **1** as shown and pivot the drive bay assembly upward.

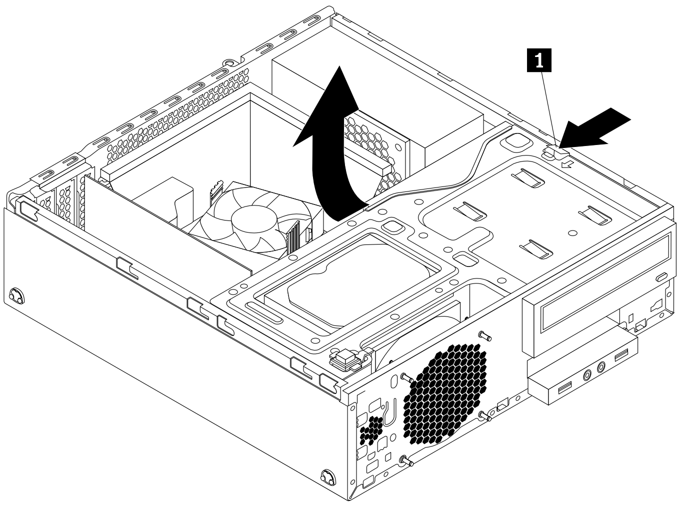


Figure 152. Pivoting the drive bay assembly upward

5. Disconnect the front antenna cable from the Wi-Fi card module.
6. Remove the front antenna and cable from the front of the computer.

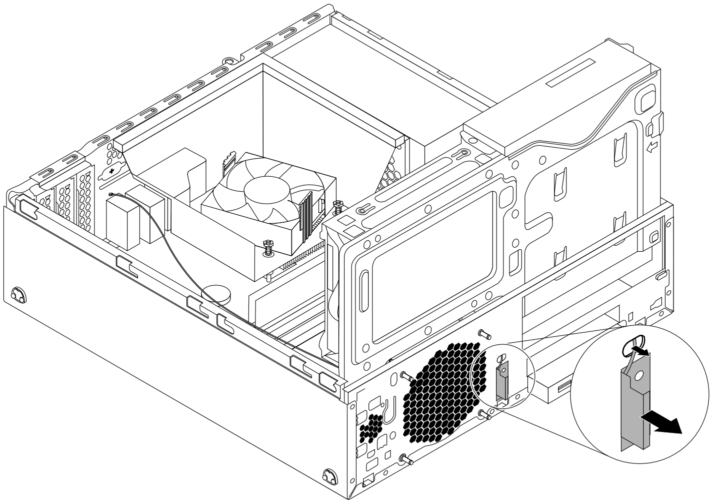


Figure 153. Removing the front Wi-Fi antenna

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Replacing the optical drive

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the optical drive.

To replace an optical drive, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 150.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 151.

4. Press the release tab **1** as shown and pivot the drive bay assembly upward.

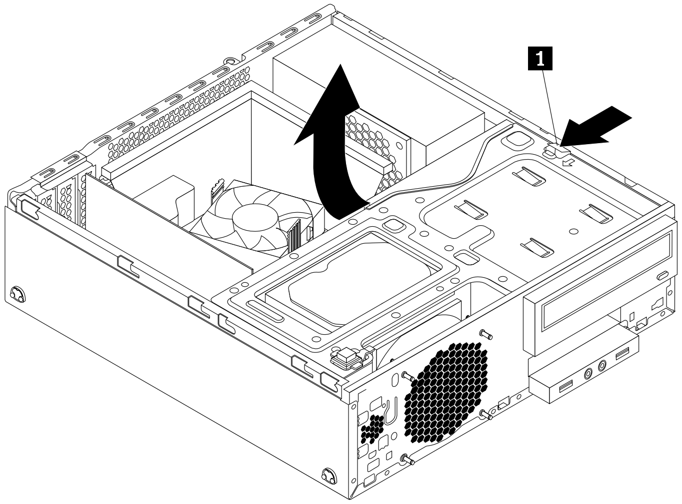


Figure 154. Pivoting the drive bay assembly upward

5. Disconnect the signal cable and the power cable from the rear of the optical drive.
6. Press the optical drive lock **1** on the right side of the drive bay assembly and slide the optical drive out of the rear of the bay.

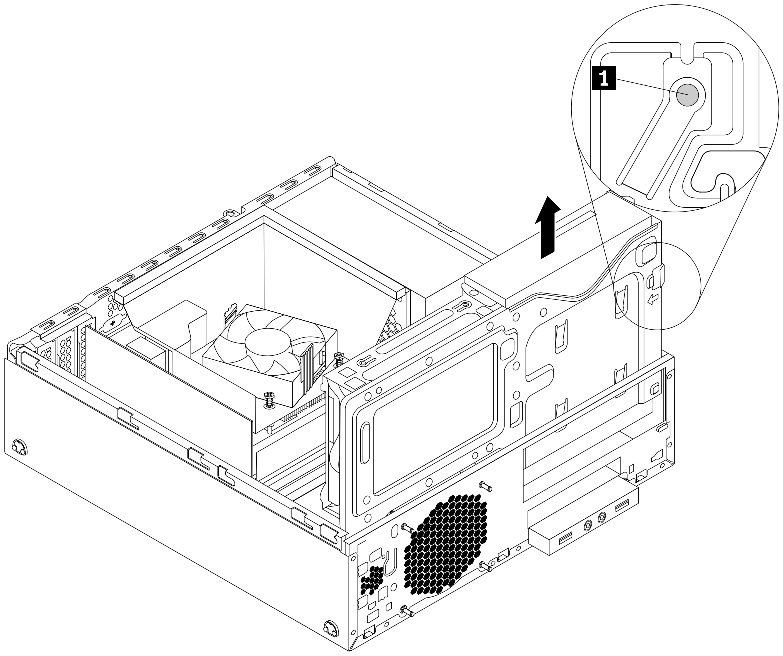


Figure 155. Removing the optical drive

7. Install the optical drive retainer on the side of the new optical drive.

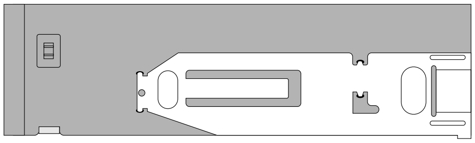


Figure 156. Installing the optical drive retainer

8. Slide the new optical drive into the drive bay until it snaps into position.

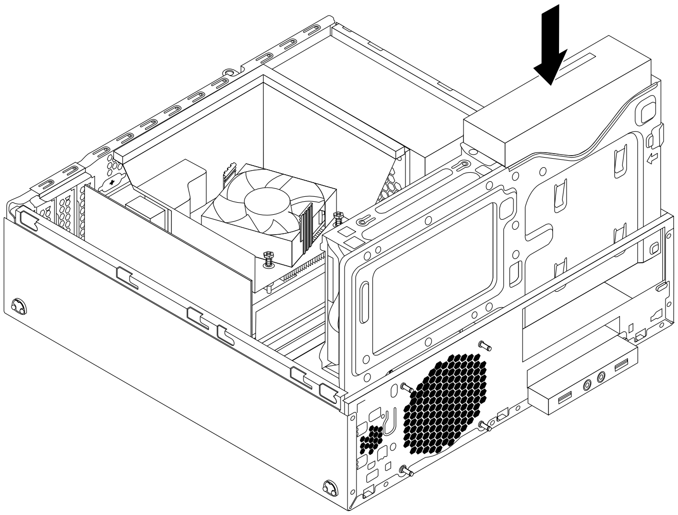


Figure 157. Installing the optical drive

9. Connect the signal cable and the power cable to the rear of the optical drive.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Replacing the heat sink and fan assembly

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the heat sink and fan assembly.

CAUTION:

⚠ ⚠

The heat sink and fan assembly might be very hot. Before you open the computer cover, turn off the computer and wait several minutes until the computer is cool.

To replace the heat sink and fan assembly, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.

2. Remove the computer cover. See “Removing the computer cover” on page 150.
3. Disconnect the heat sink and fan assembly cable from the microprocessor fan connector on the system board. See “Locating parts on the system board” on page 82.
4. Follow this sequence to remove the four screws that secure the heat sink and fan assembly to the system board:
    a. Partially remove screw **1**, then fully remove screw **2**, and then fully remove screw **1**.
    b. Partially remove screw **3**, then fully remove screw **4**, and then fully remove screw **3**.

    Note: Carefully remove the four screws from the system board to avoid any possible damage to the system board. The four screws cannot be removed from the heat sink and fan assembly.

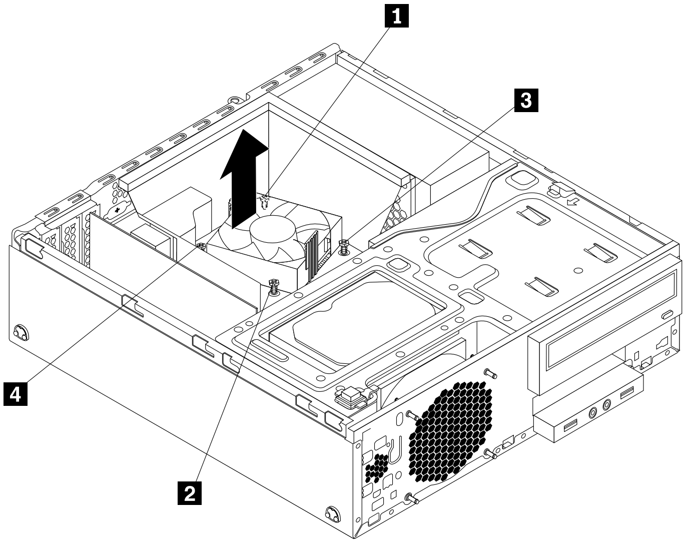


Figure 158. Screws that secure the heat sink and fan assembly

5. Lift the failing heat sink and fan assembly off the system board.

    Notes:

    a. You might have to gently twist the heat sink and fan assembly to free it from the microprocessor.
    b. Do not touch the thermal grease while handling the heat sink and fan assembly.

6. Pivot the two plastic retaining clips that secure the heat sink fan duct outward. Then remove the heat sink fan duct from the failing heat sink and fan assembly.

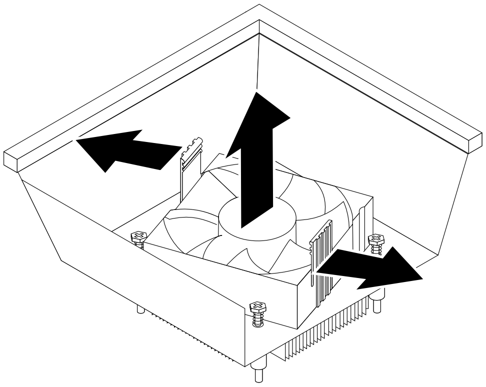


Figure 159. Removing the heat sink fan duct

7. Place the new heat sink and fan assembly on the system board so that the four screws are aligned with the corresponding holes in the system board. Ensure that you properly place the new heat sink and fan assembly so that you can easily connect the new heat sink and fan assembly cable to the microprocessor fan connector on the system board.
8. Follow this sequence to install the four screws to secure the new heat sink and fan assembly, as shown in Figure 158 "Screws that secure the heat sink and fan assembly" on page 190:
   a. Partially tighten screw **1**, then fully tighten screw **2**, and then fully tighten screw **1**.
   b. Partially tighten screw **3**, then fully tighten screw **4**, and then fully tighten screw **3**.
9. Connect the heat sink and fan assembly cable to the microprocessor fan connector on the system board. See "Locating parts on the system board" on page 82.
10. Lower and position the heat sink fan duct on the top of the heat sink and fan assembly until it snaps into position.

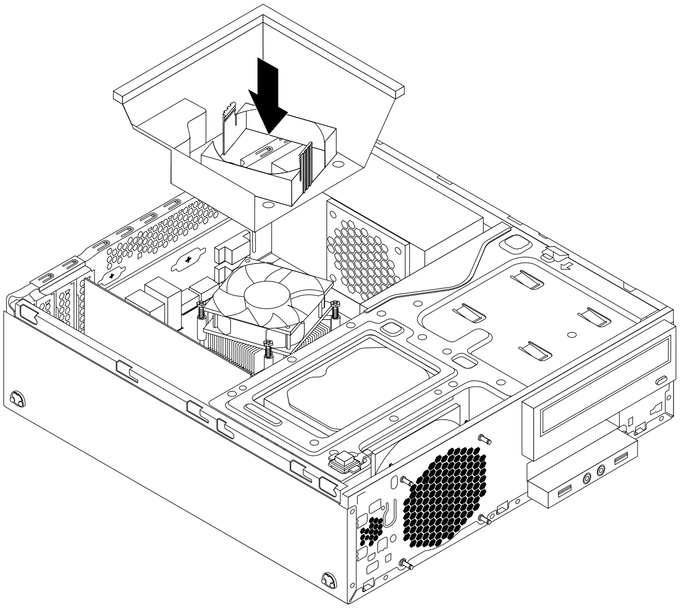


Figure 160. Installing the heat sink fan duct

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

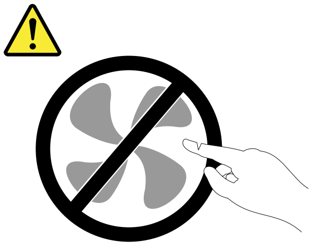
Replacing the power supply assembly

> **Attention:**
> Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the power supply assembly.

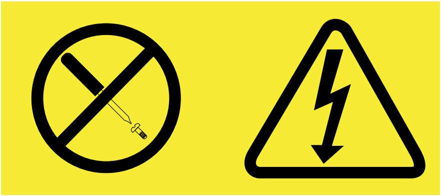
Although there are no moving parts in your computer after the power cord has been disconnected, the following warnings are required for your safety and proper Underwriters Laboratories (UL) certification.

CAUTION:



Hazardous moving parts. Keep fingers and other body parts away.

CAUTION:
Never remove the cover on a power supply or any part that has the following label attached.



Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

To replace the power supply assembly, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See “Removing the computer cover” on page 150.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 151.

4. Gently pivot the two plastic retaining clips that secure the heat sink fan duct outward, and then lift the heat sink fan duct out of the chassis.

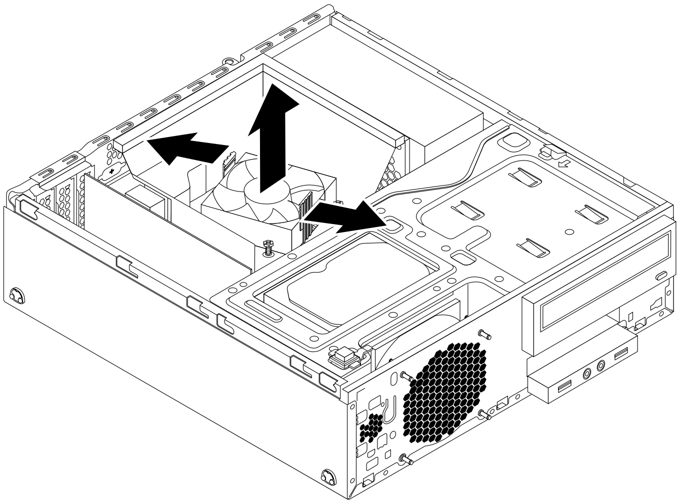


Figure 161. Removing the heat sink fan duct

5. Press the release tab **1** as shown and pivot the drive bay assembly upward.

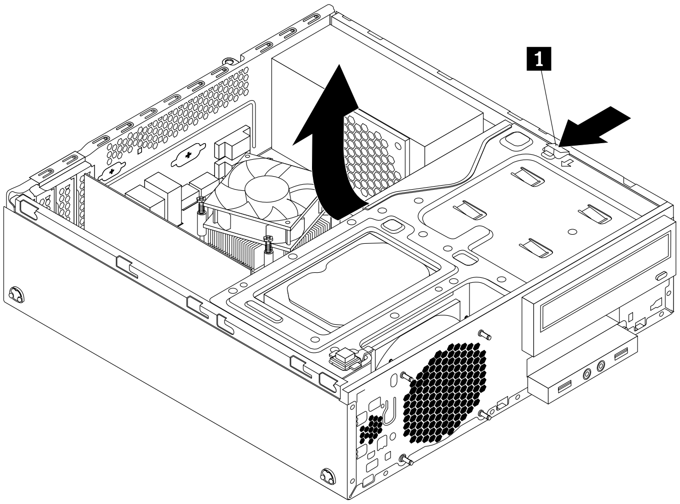


Figure 162. Pivoting the drive bay assembly upward

6. Record the cable routing and cable connections. Then, disconnect the power supply assembly cables from all drives and from power connectors **1**, **2**, and **3** on the system board.

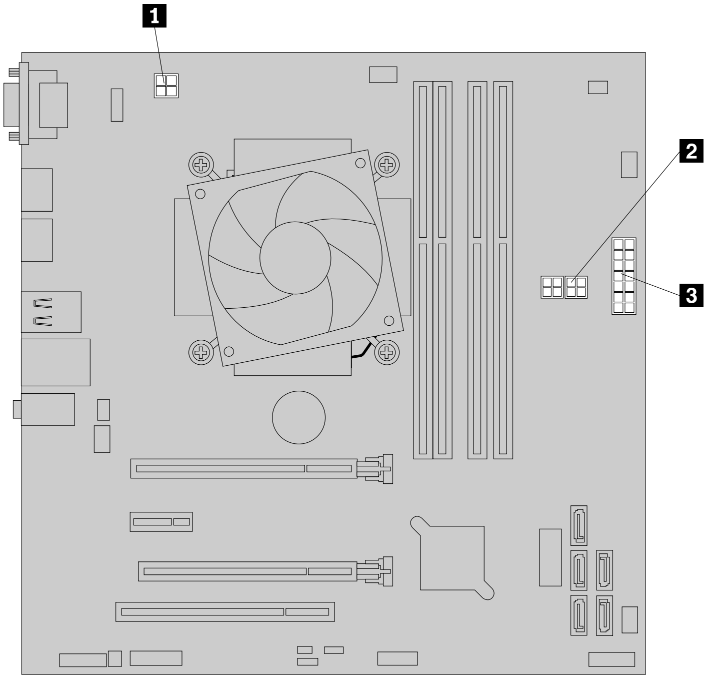


Figure 163. Power connectors on the system board

7. Release the power supply assembly cables from any cable clips or ties that secure the cables to the chassis.
8. At the rear of the computer, remove the three screws that secure the power supply assembly. Press the power supply clip **1** downward to release the power supply assembly and then slide the power supply assembly to the front of the computer. Lift the power supply assembly out of the computer.

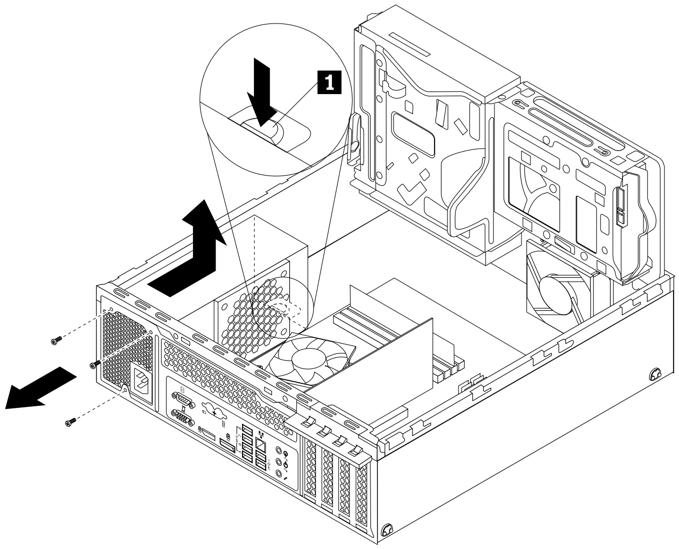


Figure 164. Removing the power supply assembly

9. Ensure that the new power supply assembly is the correct replacement.
10. Install the new power supply assembly into the chassis so that the screw holes in the new power supply assembly are aligned with the corresponding holes in the rear of the chassis. Then, install the three screws to secure the new power supply assembly in place.

    Note: Use only screws provided by Lenovo.

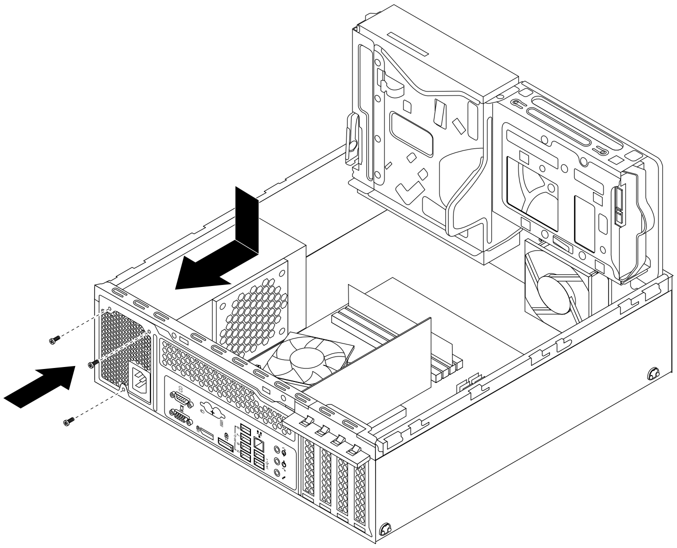


Figure 165. Installing the power supply assembly

11. Connect the new power supply assembly cables to all drives and the system board. See “Locating parts on the system board” on page 82.
12. Press the release tab **1** as shown and pivot the drive bay assembly downward until it snaps into position.

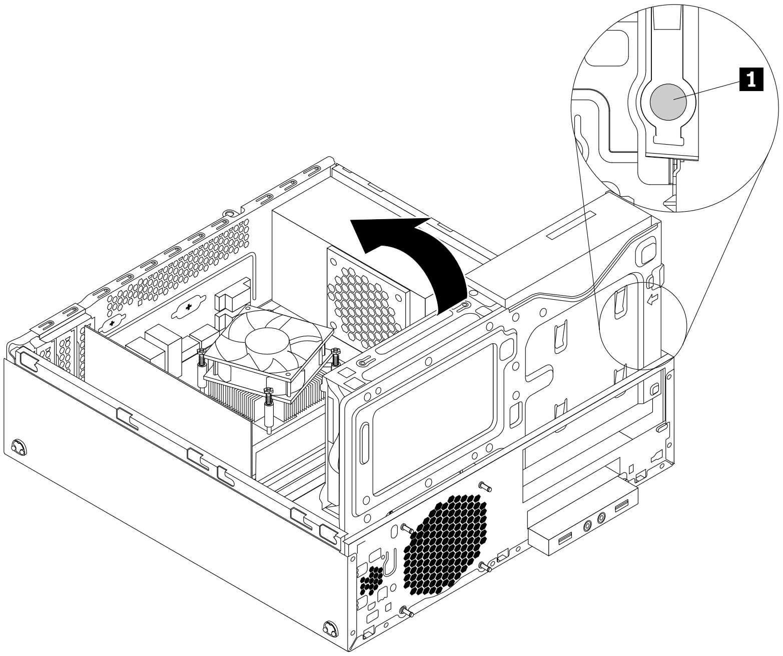


Figure 166. Pivoting the drive bay assembly downward

13. Position the heat sink fan duct on the top of the heat sink as shown. Then, press the heat sink fan duct straight down until it snaps into position.

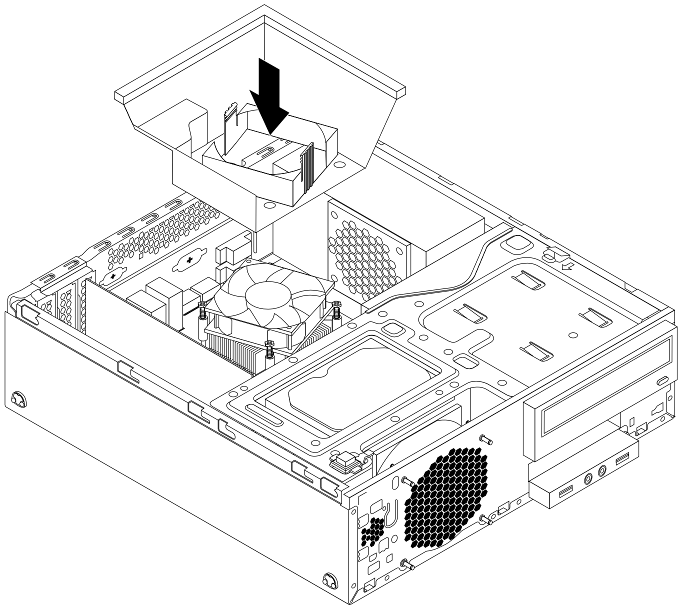


Figure 167. Installing the heat sink fan duct

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to “Completing the parts replacement” on page 216.

Replacing the microprocessor

Attention:
Do not open your computer or attempt any repair before reading and understanding the "Important safety information" on page 1.

This section provides instructions on how to replace the microprocessor.

CAUTION:

⚠ ⚠

The heat sink and microprocessor might be very hot. Before you open the computer cover, turn off the computer and wait several minutes until the computer is cool.

To replace the microprocessor, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See "Removing the computer cover" on page 150.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 151.
4. Press the release tab **1** as shown and pivot the drive bay assembly upward.

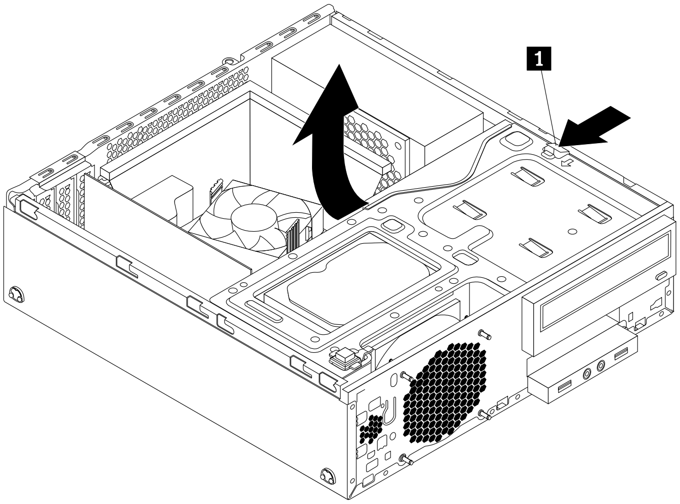


Figure 168. Pivoting the drive bay assembly upward

5. Remove the heat sink and fan assembly. See "Replacing the heat sink and fan assembly" on page 189.

   Note: Place the heat sink and fan assembly on its side so that the thermal grease on the bottom of it does not get in contact with anything.
6. Record the cable routing and connections. Then, locate the system board and disconnect all cables connected to the system board. See "Locating parts on the system board" on page 82.

7. Lift the small handle **1** and open the retainer **2** to access the microprocessor **3**.

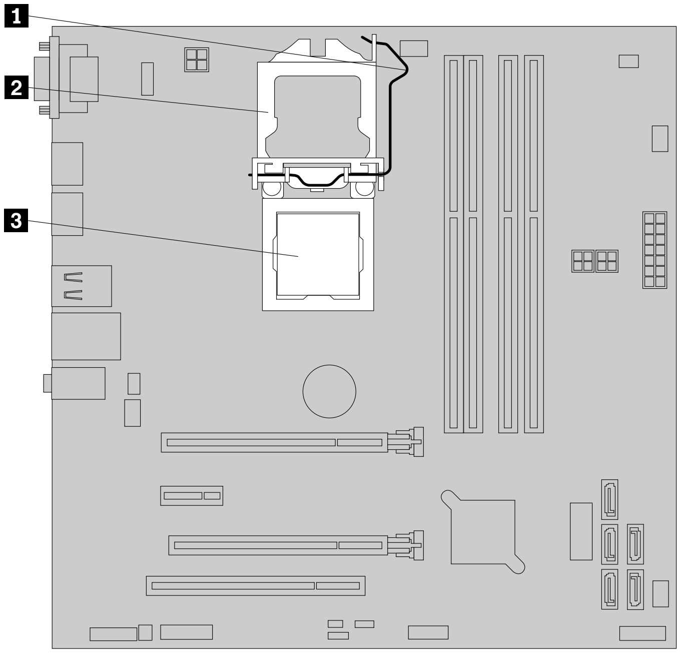


Figure 169. Accessing the microprocessor

8. Carefully lift the microprocessor straight up and out of the microprocessor socket.

   Notes:

   - Your microprocessor and socket might look different from the one illustrated.
   - Touch only the edges of the microprocessor. Do not touch the gold contacts on the bottom.
   - Do not drop anything onto the microprocessor socket while it is exposed. The socket pins must be kept as clean as possible.

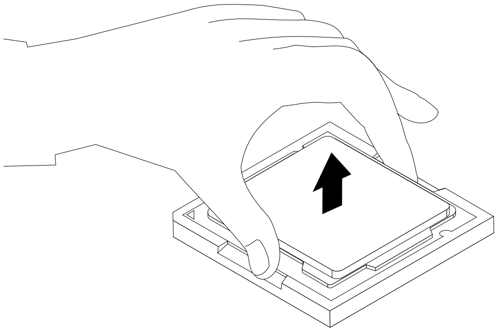


Figure 170. Removing the microprocessor

9. Ensure that the small handle is in the raised position and the microprocessor retainer is fully open.
10. Remove the protective cover that protects the gold contacts of the new microprocessor.

11. Note the orientation of the new microprocessor. Hold the new microprocessor by its edges and align the notches **1** on it with the tabs **2** in the microprocessor socket. Then, carefully lower the new microprocessor straight down into the microprocessor socket.

    Note: The small triangle **3** on one corner of the new microprocessor is the microprocessor orientation indicator. The new microprocessor is in the correct orientation when this indicator points to the beveled corner **4** of the microprocessor socket.

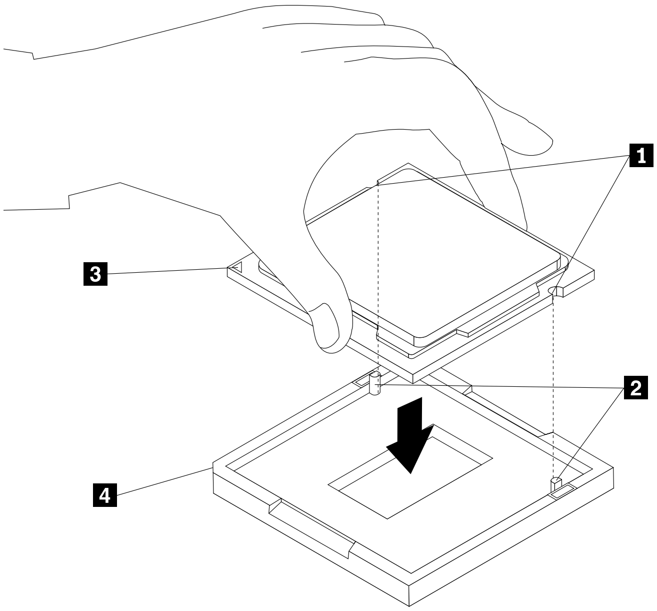


Figure 171. Installing the microprocessor

12. Close the microprocessor retainer and lock it into position with the small handle to secure the new microprocessor in the socket.
13. Reinstall the heat sink and fan assembly with the fan duct as shown. See "Replacing the heat sink and fan assembly" on page 189.

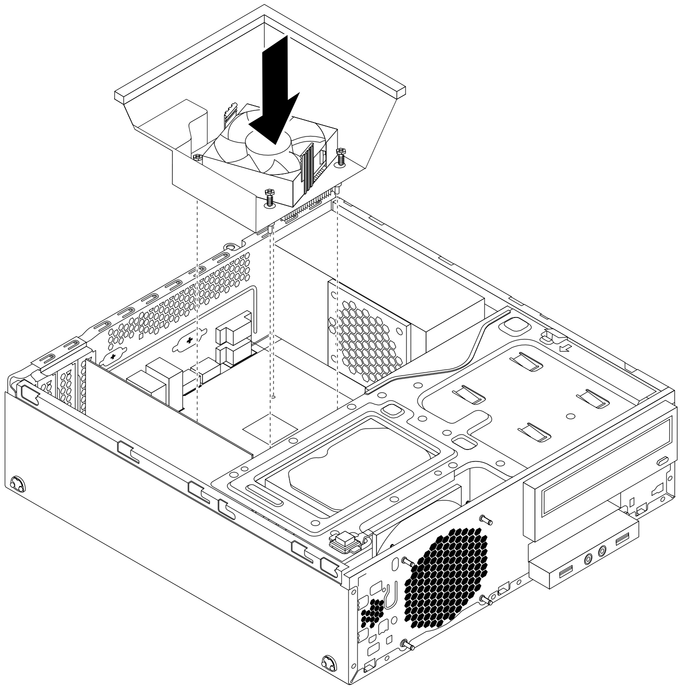


Figure 172. Reinstalling the heat sink and fan assembly with the fan duct

14. Reconnect all cables that were disconnected from the system board.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the replacement, go to “Completing the parts replacement” on page 216.

Replacing the cover presence switch

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the cover presence switch, also known as intrusion switch.

To replace the cover presence switch, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 150.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 151.
4. Locate the cover presence switch. See “Locating major FRUs and CRUs” on page 79.
5. Disconnect the cover presence switch cable from the system board.

6. Press the clip **1** as shown and lift the cover presence switch up to remove it from the chassis.

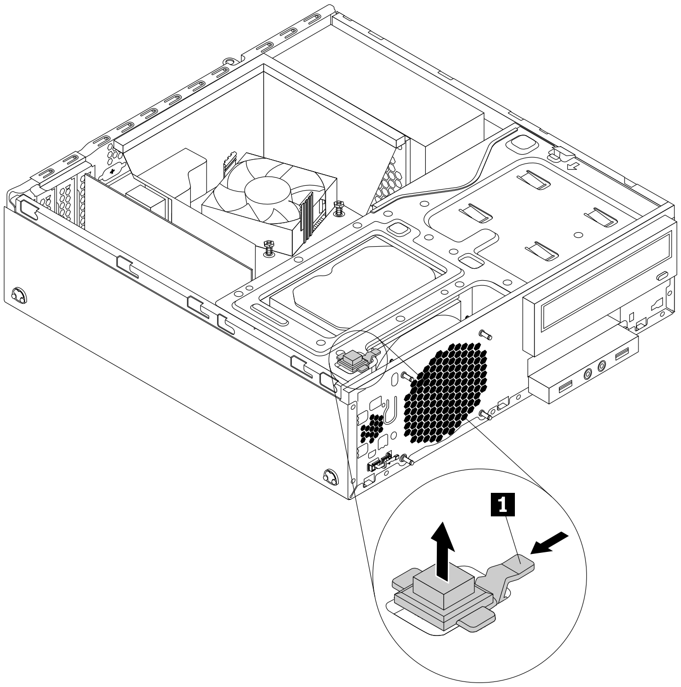


Figure 173. Removing the cover presence switch

7. Put the new cover presence switch into the hole and press it down until it snaps into position.

   Note: Note the orientation of the cover presence switch.

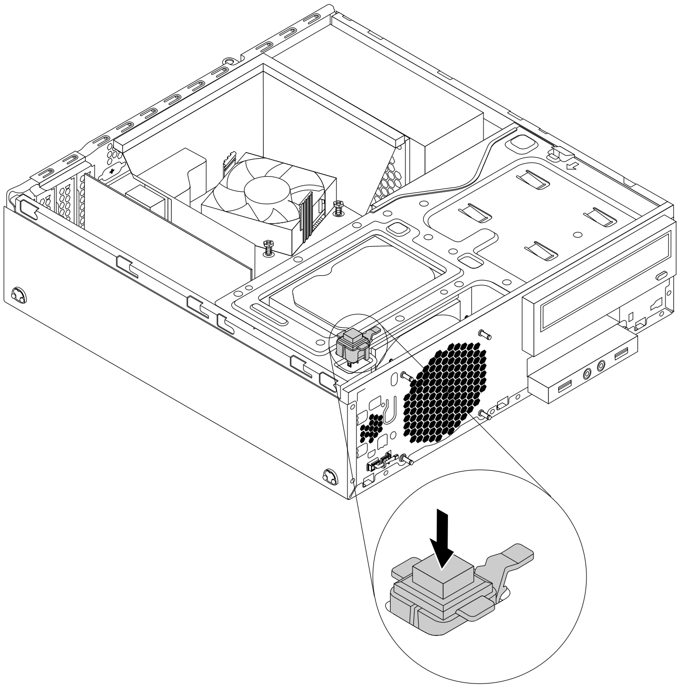


Figure 174. Installing the cover presence switch

8. Reconnect the cover presence switch cable to the cover presence switch connector on the system board. See "Locating parts on the system board" on page 82.
9. Reinstall the front bezel. See "Removing and reinstalling the front bezel" on page 151.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 216.

Replacing the internal speaker

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to replace the internal speaker.

Note: The internal speaker is only available in some models.

To replace the internal speaker, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 150.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 151.

4. Press the release tab **1** as shown and pivot the drive bay assembly upward.

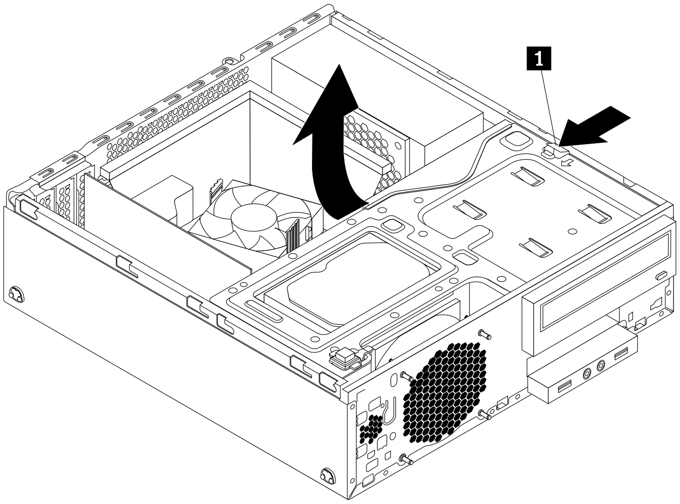


Figure 175. Pivoting the drive bay assembly upward

5. Disconnect the internal speaker cable from the system board.
6. Push the tab **1** from inside and slide the internal speaker to the left to remove it from the chassis.

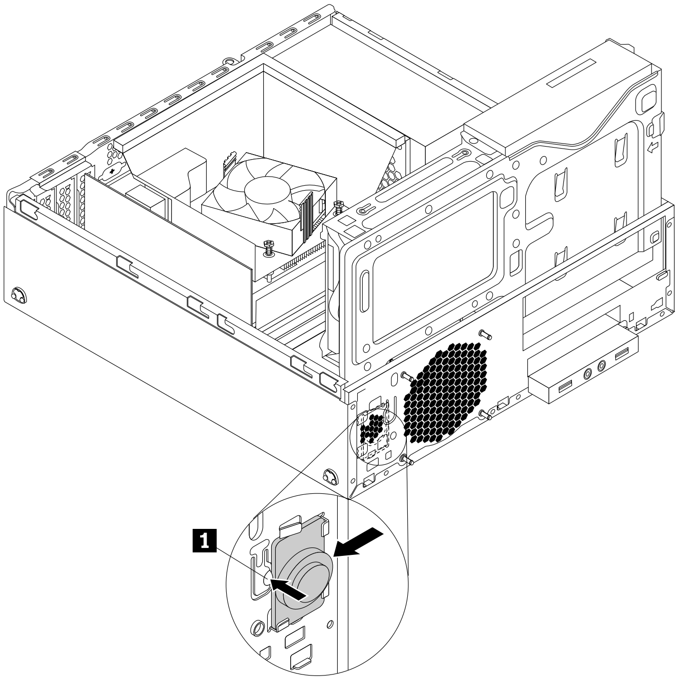


Figure 176. Removing the internal speaker

7. Align the new internal speaker with the four metal clips **1** on the inner side of chassis, and then slide the speaker to the right until it snaps into position.

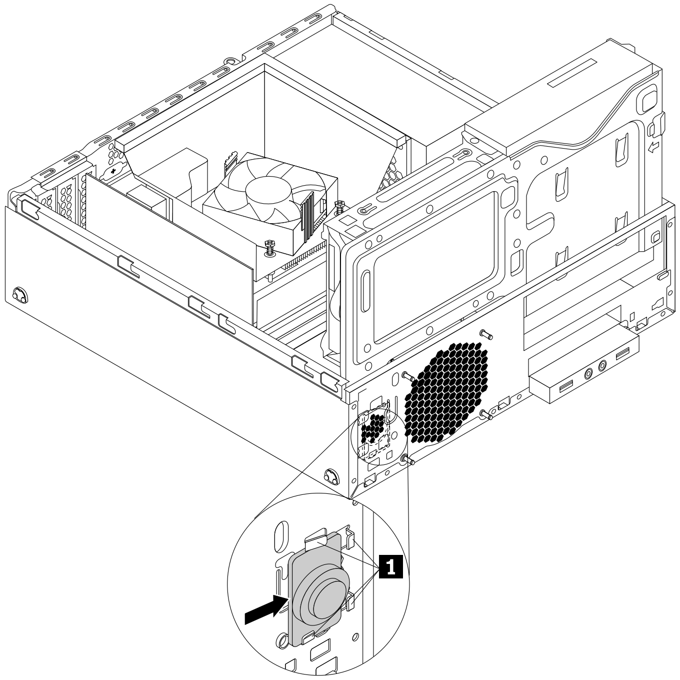


Figure 177. Installing the internal speaker

8. Connect the internal speaker cable to the internal speaker connector on the system board. See "Locating parts on the system board" on page 82.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 216.

Replacing the front audio and USB assembly

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to replace the front audio and USB assembly.

To replace the front audio and USB assembly, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. See "Removing the computer cover" on page 150.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 151.

4. Press the release tab **1** as shown and pivot the drive bay assembly upward.

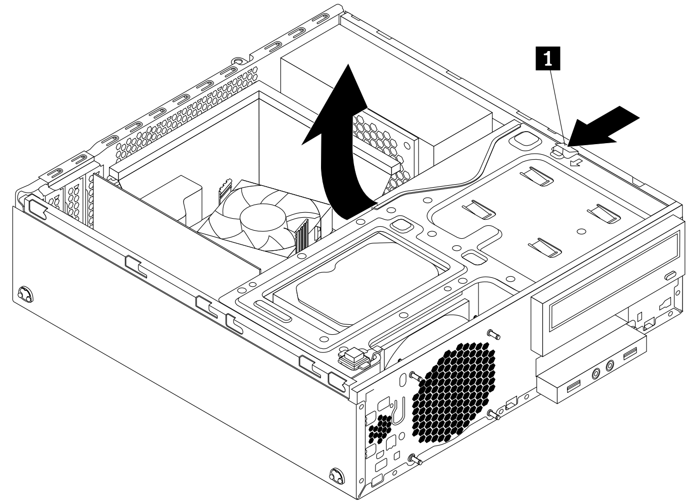


Figure 178. Pivoting the drive bay assembly upward

5. Disconnect the front audio and USB assembly cables from the system board and note the cables routing. See "Locating parts on the system board" on page 82.
6. Remove the screw that secures the front audio and USB assembly bracket. Then remove the front audio and USB assembly bracket from the chassis.

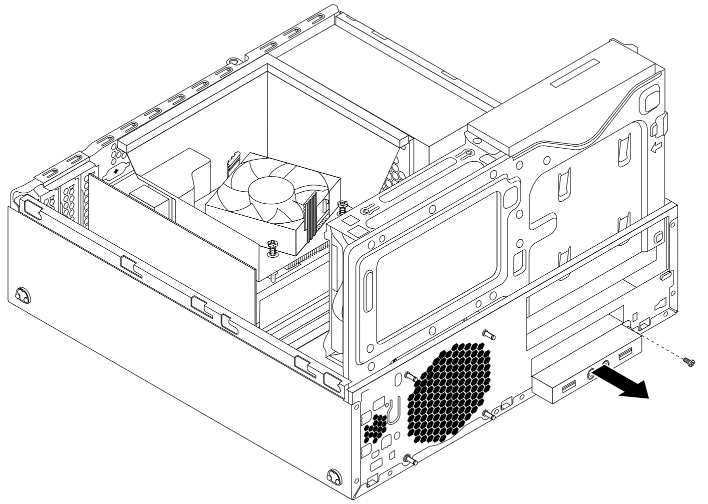


Figure 179. Removing the front audio and USB assembly

7. Remove the two screws that secure the front audio and USB assembly to its bracket. Then remove the failing front audio and USB assembly from the bracket.
8. Install a new front audio and USB assembly into the bracket and install the two screws to secure the front audio and USB assembly to the bracket.
9. Install the front audio and USB assembly bracket to the chassis and align the screw hole in the bracket with the corresponding hole in the chassis.
10. Install the screw to secure the front audio and USB assembly bracket to the chassis.

11. Reconnect the front USB and front audio cables to the system board. See “Locating parts on the system board” on page 82.
12. Reinstall the front bezel. See “Removing and reinstalling the front bezel” on page 151.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Replacing the system fan

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the system fan.

To replace the system fan, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 150.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 151.
4. Press the release tab **1** as shown and pivot the drive bay assembly upward.

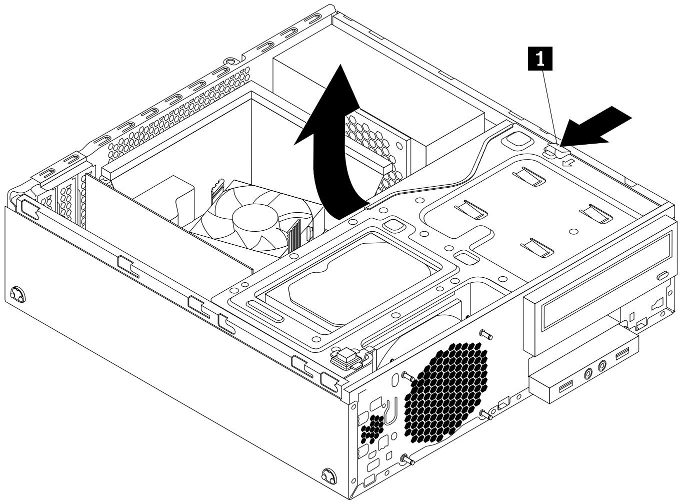


Figure 180. Pivoting the drive bay assembly upward

5. Disconnect the system fan cable from the system fan connector on the system board. See “Locating parts on the system board” on page 82.

6. The system fan is attached to the chassis by four rubber mounts. Remove the system fan by cutting the rubber mounts and lifting the system fan out of the chassis.

   Note: The new front fan assembly will have four new rubber mounts attached.

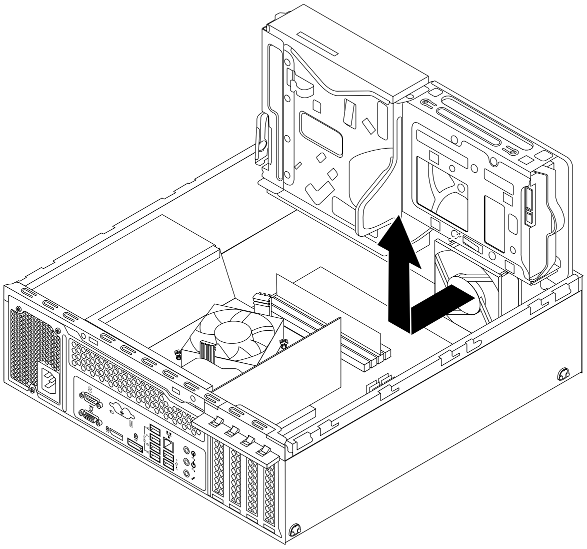


Figure 181. Removing the system fan

7. Install the new system fan by aligning the new rubber mounts that came with the new system fan with the corresponding holes in the chassis, and then push the rubber mounts through the holes. Then, carefully pull on the tips of the rubber mounts from the bottom until the new system fan is secured in place.

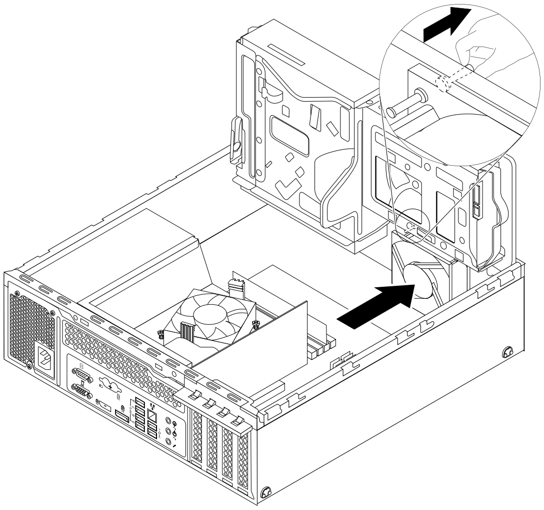


Figure 182. Installing the system fan

8. Connect the new system fan cable to the system fan connector on the system board. See “Locating parts on the system board” on page 82.

What to do next:

- To work with another piece of hardware, go to the appropriate section.

- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Replacing the thermal sensor

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the thermal sensor.

To replace the thermal sensor, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See “Removing the computer cover” on page 150.
3. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 151.
4. Locate the thermal sensor. See “Locating major FRUs and CRUs” on page 79.
5. Press the release tab **1** as shown and pivot the drive bay assembly upward.

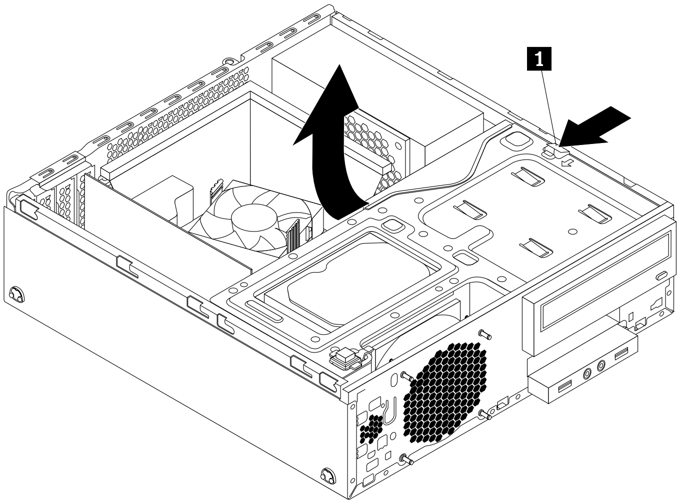


Figure 183. Pivoting the drive bay assembly upward

6. Disconnect the thermal sensor cable from the thermal sensor connector on the system board. See “Locating parts on the system board” on page 82.

7. From inside the chassis, pivot the left retaining clip **1** that secures the plastic holder of the thermal sensor and then push the clip outward to release the clip. Then disengage the plastic holder holding the thermal sensor from the chassis.

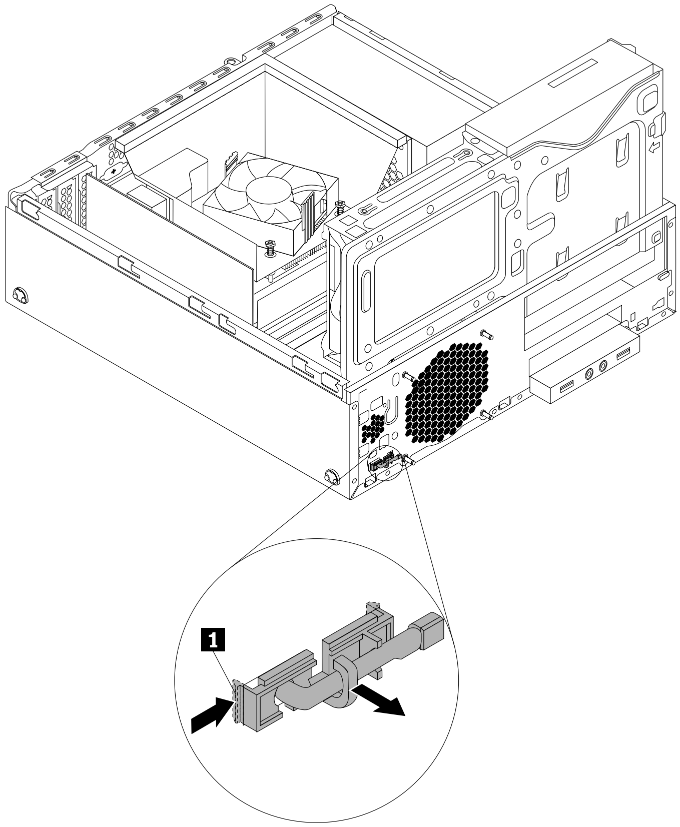


Figure 184. Removing the thermal sensor

8. Pull the entire thermal sensor out of the chassis.

9. Insert the connector and cable of the new thermal sensor into the left hole **1** in the chassis. Then align the two tabs on the plastic holder holding the thermal sensor with the two holes **1** and **2** in the chassis, and press the plastic holder until it snaps into position.

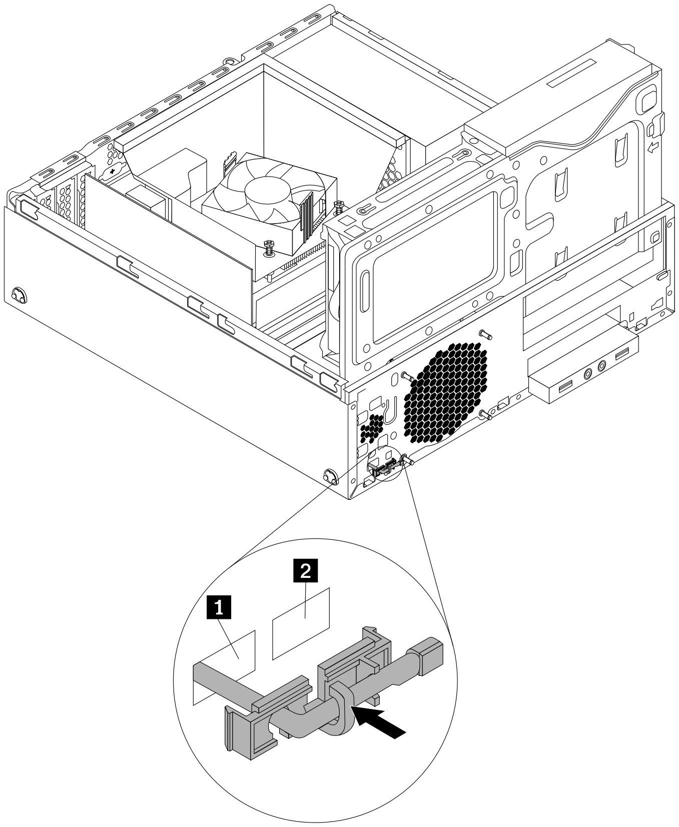


Figure 185. Installing the new thermal sensor

10. Reconnect the thermal sensor cable to the system board. See "Locating parts on the system board" on page 82.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to "Completing the parts replacement" on page 216.

Replacing the power switch

> **Attention:**
> Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to replace the power switch.

To replace the power switch, do the following:

1. Turn off the computer and disconnect all power cords from electrical outlets.
2. Remove the computer cover. See "Removing the computer cover" on page 150.
3. Remove the front bezel. See "Removing and reinstalling the front bezel" on page 151.
4. Locate the power switch. See "Locating major FRUs and CRUs" on page 79.

5. Press the release tab **1** as shown and pivot the drive bay assembly upward.

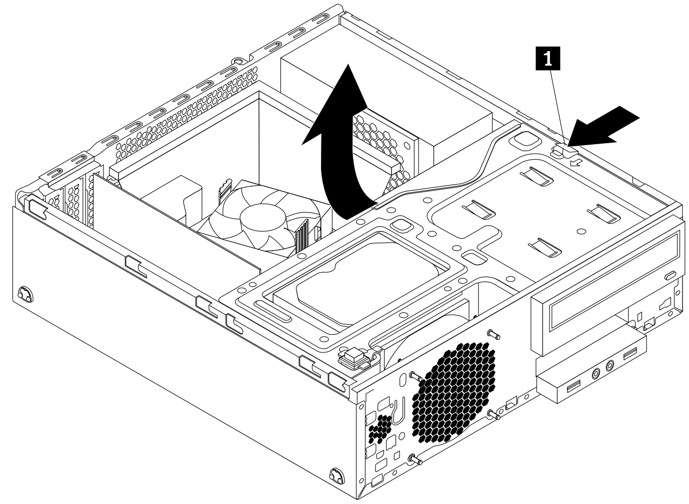


Figure 186. Pivoting the drive bay assembly upward

6. Disconnect the power switch cable from the power switch connector on the system board. See "Locating parts on the system board" on page 82.
7. Push the power switch inward through the hole to disengage it from the chassis.

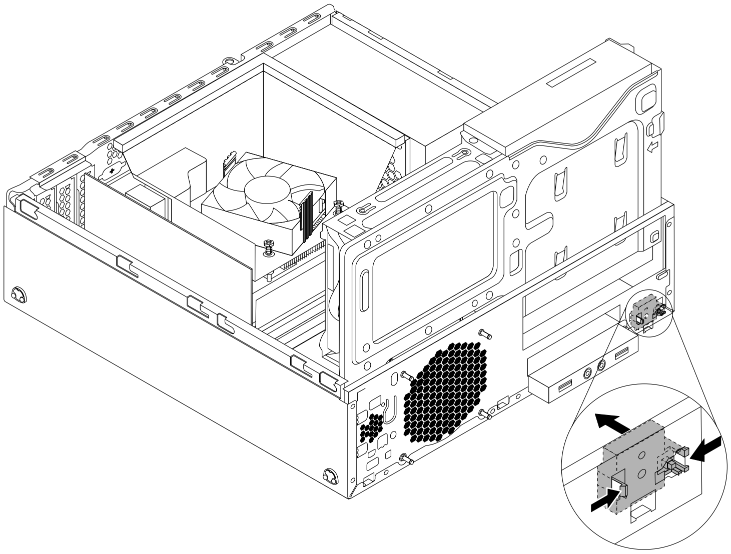


Figure 187. Removing the power switch

8. Insert the two plastic tabs in the new power switch through the hole on the chassis, and then press the power switch as shown until it snaps into position.

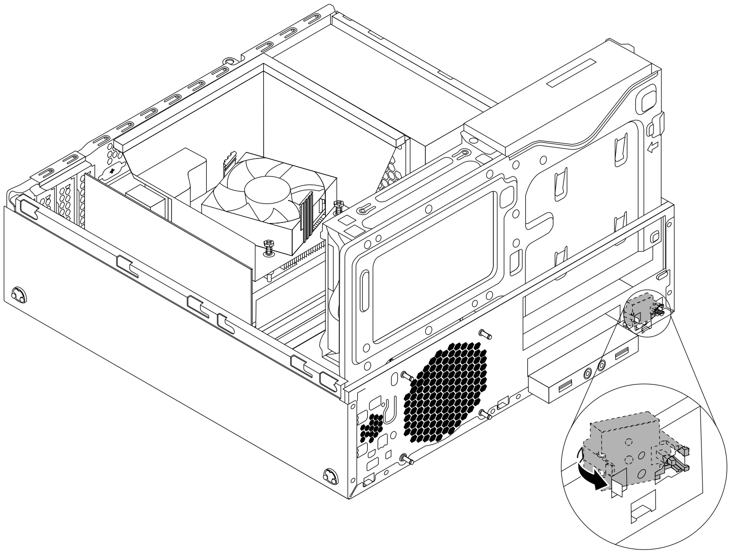


Figure 188. Installing the new power switch

9. Reconnect the power switch cable to the system board. See “Locating parts on the system board” on page 82.
10. Reinstall the front bezel. See “Removing and reinstalling the front bezel” on page 151.

What to do next:

- To work with another piece of hardware, go to the appropriate section.
- To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

Replacing the system board

Attention:
Do not open your computer or attempt any repair before reading and understanding “Important safety information” on page 1.

This section provides instructions on how to replace the system board.

CAUTION:

⚠ ⚠

The heat sink and microprocessor might be very hot. Before you open the computer cover, turn off the computer and wait several minutes until the computer is cool.

To replace the system board, do the following:

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Lay the computer on its side for easier access to the system board.
3. Remove the computer cover. See “Removing the computer cover” on page 150.
4. Remove the front bezel. See “Removing and reinstalling the front bezel” on page 151.

5. Press the release tab **1** as shown and pivot the drive bay assembly upward.

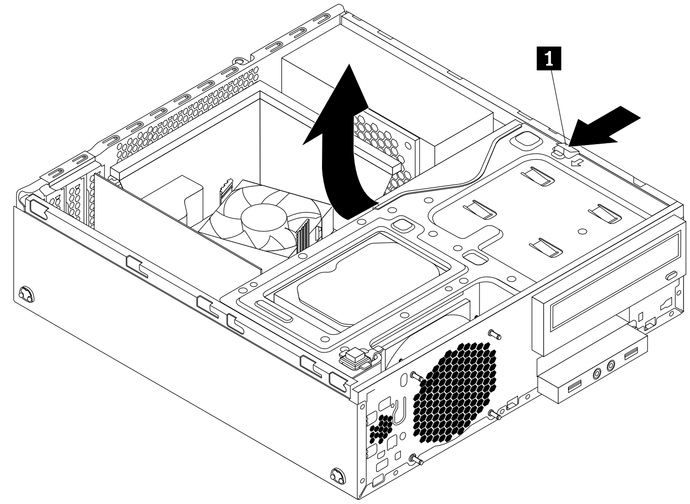


Figure 189. Pivoting the drive bay assembly upward

6. Remove all memory modules and PCI cards that are currently installed. See "Installing or replacing a memory module" on page 152 and "Installing or replacing a PCI card" on page 154.
7. Remove the heat sink and fan assembly from the failing system board. See "Replacing the heat sink and fan assembly" on page 189.
8. Record the cable routing and cable connections and then disconnect all cables from the system board. See "Locating parts on the system board" on page 82.

9. Remove the eight screws that secure the system board by following the sequence shown in the following illustration.

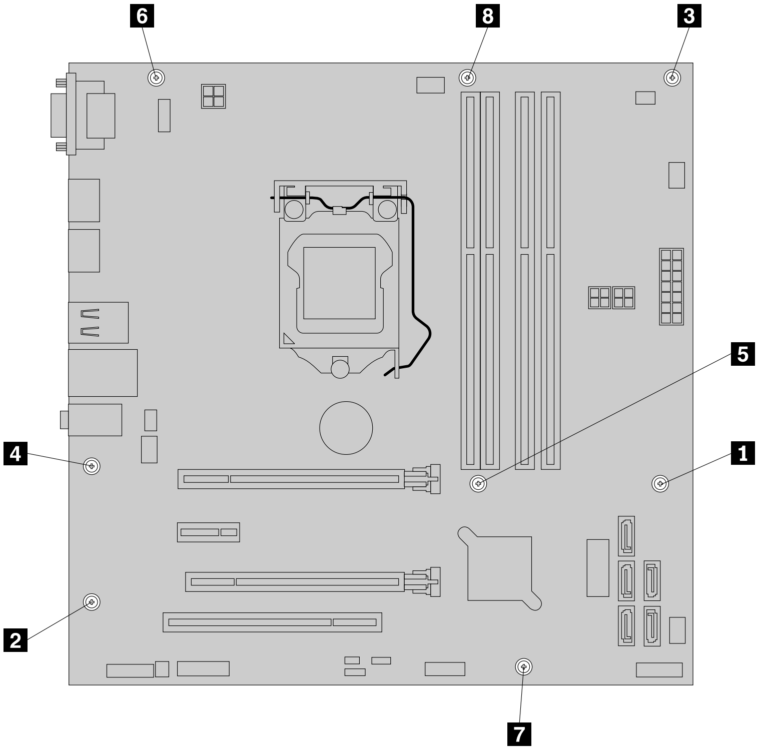


Figure 190. Removing the eight screws that secure the system board

10. Slide the system board to the front of the computer and then carefully lift the system board out of the chassis.
11. Remove the microprocessor from the failing system board and install it on the new system board. See "Replacing the microprocessor" on page 197.

12. Install the new system board into the chassis by aligning the eight screw holes in the new system board with the corresponding mounting studs on the chassis. Then, install the eight screws to secure the system board by following the sequence shown in the following illustration.

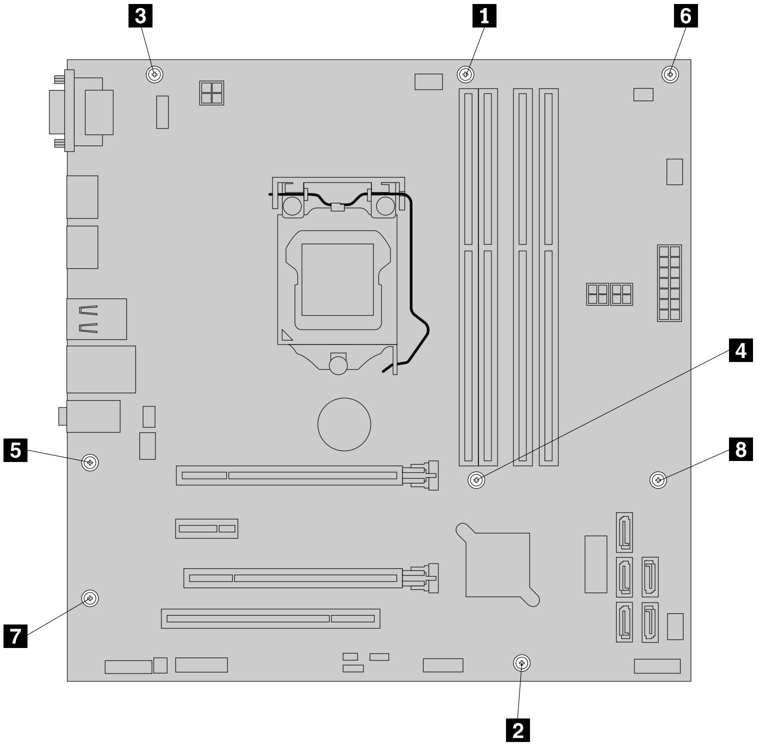


Figure 191. Installing the eight screws to secure the system board

13. Install the heat sink and fan assembly and connect the heat-sink-and-fan-assembly cable to the new system board. See “Replacing the heat sink and fan assembly” on page 189.
14. Install all memory modules and PCI cards removed from the failing system board onto the new system board. See “Installing or replacing a memory module” on page 152 and “Installing or replacing a PCI card” on page 154.
15. Refer to your record to connect cables to the new system board. You also can refer to “Locating parts on the system board” on page 82 to help you locate the connectors on the system board and connect cables.
16. To complete the installation or replacement, go to “Completing the parts replacement” on page 216.

The failing system board must be returned with a microprocessor socket cover to protect the pins during shipping and handling.

To install the microprocessor socket cover, do the following:

1. After you have removed the microprocessor from the failing system board, close the microprocessor retainer and then put the lever to the locked position to secure the retainer in place.

2. Note the orientation of the socket cover, and install one side of the socket cover into the microprocessor socket. Carefully press the other side of the socket cover downward until the socket cover snaps into position.

   Note: Your microprocessor socket and cover might look slightly different from the illustration.

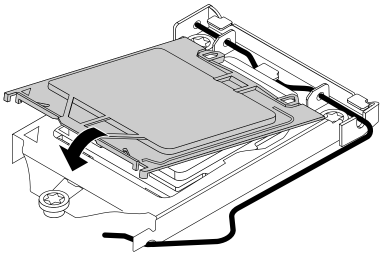


Figure 192. Installing the microprocessor socket cover

3. Carefully check the four corners of the socket cover to ensure that the cover is seated securely.
4. Follow any additional instructions that are included with the replacement part you received.

Replacing the keyboard or mouse

Attention:
Do not open your computer or attempt any repair before reading and understanding "Important safety information" on page 1.

This section provides instructions on how to replace the keyboard or mouse.

To replace the keyboard or mouse, do the following:

1. Disconnect the old keyboard cable or mouse cable from the computer.
2. Connect a new keyboard or mouse to one of the USB connectors on the computer. Depending on where you want to connect the new keyboard or mouse, see "Locating connectors, controls, and indicators on the front of your computer" on page 77 or "Locating connectors on the rear of your computer" on page 78.

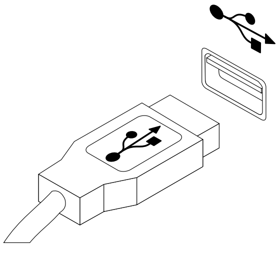


Figure 193. Connecting the USB keyboard or mouse

Completing the parts replacement

After completing the installation or replacement for all parts, you need to reinstall the computer cover and reconnect cables. Depending on the parts you installed or replaced, you might need to confirm the updated information in the Setup Utility program. Refer to Chapter 6 "Using the Setup Utility program" on page 55.

To reinstall the computer cover and reconnect cables to your computer, do the following:

1. Ensure that all components have been reassembled correctly and that no tools or loose screws are left inside your computer. See “Locating major FRUs and CRUs” on page 79 for the locations of various components in your computer.
2. If you have removed the front bezel, reinstall it. To reinstall the front bezel, align the three tabs on the front bezel with the corresponding holes in the chassis and pivot the front bezel inwards until it snaps into position.
3. Ensure that the cables are routed correctly before reinstalling the computer cover. Keep cables clear of the hinges and sides of the computer chassis to avoid interference with closing the computer cover.
4. Press the release tab **1** as shown and pivot the drive bay assembly downward until it snaps into position.

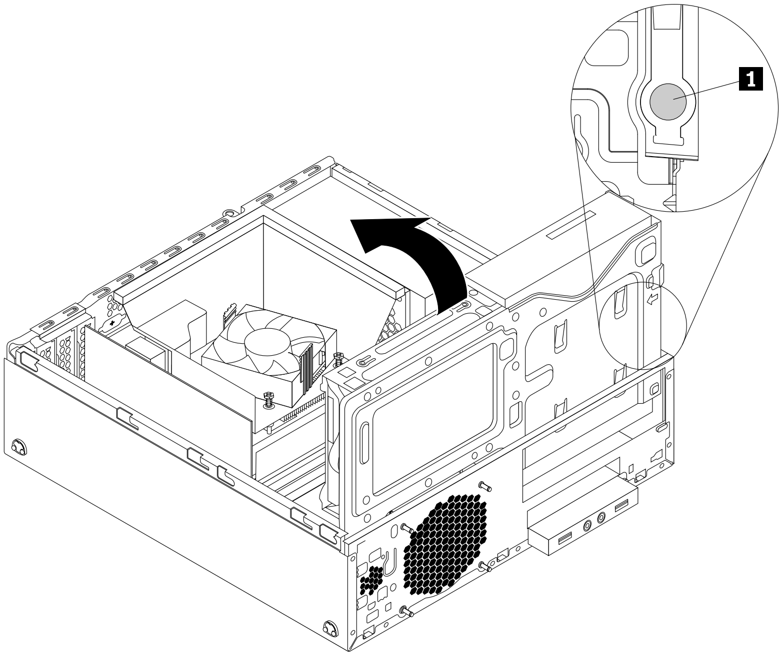


Figure 194. Pivoting the drive bay assembly downward

5. Position the computer cover on the chassis so that the rail guides on the bottom of the computer cover engage the rails on the chassis. Then, push the cover to the front of the computer until it snaps into position. Install the screws to secure the computer cover.

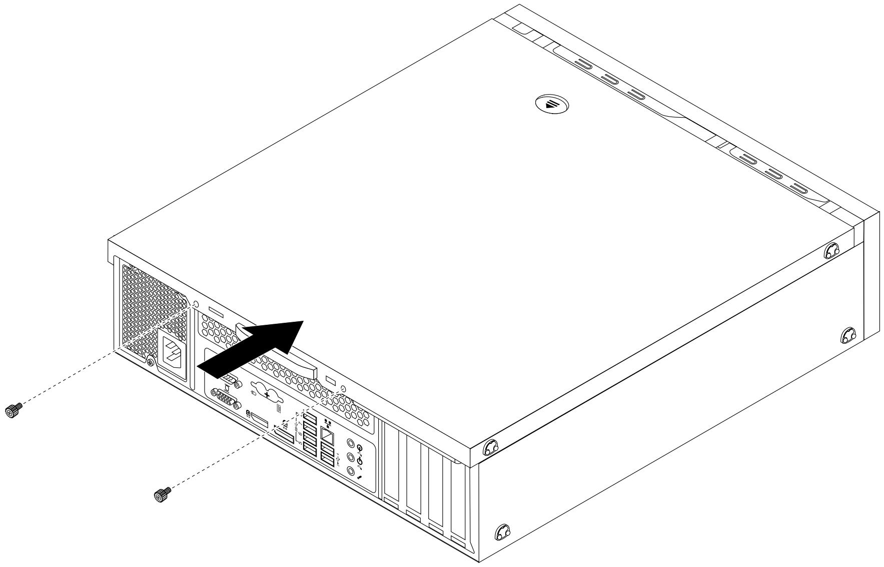


Figure 195. Reinstalling the computer cover

6. If there is a padlock available, lock the computer.
7. If there is a Kensington-style cable lock available, lock the computer.
8. Reconnect the external cables and power cords to the computer. See “Locating connectors on the rear of your computer” on page 78.
9. To update your configuration, refer to Chapter 6 “Using the Setup Utility program” on page 55.

Note: In most areas of the world, Lenovo requires the return of the defective Field Replaceable Units (FRUs). Information about this will come with the new FRUs or will come a few days after you receive the new FRUs.

Obtaining device drivers

You can obtain device drivers that are not preinstalled in your operating system at http://www.lenovo.com/support. Installation instructions are provided in readme files with the device-driver files.

Chapter 12. Additional service information

This chapter provides additional information that the service representative might find helpful.

Security features

Security features in this section include the following:

- Passwords
- Vital Product Data
- Management Information Format (MIF)

Hardware controlled passwords

Hardware controlled passwords are set using the Setup Utility program. For more information about passwords, see "Using passwords" on page 55.

Operating system password

An operating system password is very similar to a power-on password and denies access to the computer by an unauthorized user when the password is activated. The computer is unusable until the password is entered and recognized by the computer.

Vital product data

Each computer has a unique Vital Product Data (VPD) code stored in the nonvolatile memory on the system board. After you replace the system board, the VPD must be updated. To update the VPD, see "Flash update procedures" on page 219.

BIOS levels

An incorrect level of BIOS can cause false errors and unnecessary FRU replacement. Use the following information to determine the current level of BIOS installed in the computer, the latest BIOS available for the computer, and where to obtain the latest level of BIOS.

- To determine the current Level of BIOS:
  - Start the Setup Utility.
  - Select Standard CMOS Features.
- Sources for obtaining the latest level BIOS available
  1. Lenovo support web site: `http://www.lenovo.com/support/`
  2. Lenovo Customer Support Center
  3. Levels 1 and 2 Support

To update (flash) the BIOS, see "Flash update procedures" on page 219.

Note: BIOS settings vary by operating system. Change the BIOS settings before installing a new operating system. See "Changing the BIOS settings before installing a new operating system" on page 60.

Flash update procedures

This section details how to flash (update) the BIOS.

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Updating (flashing) the BIOS from a disc

This section provides instructions on how to update (flash) the BIOS from a disc on the Windows 8 (64-bit) or Windows 8.1 (64-bit) operating system and on other operating systems.

Note: You can download a self-starting bootable disc image (known as an ISO image) with the system program updates to create a system-program-update disc. Go to http://www.lenovo.com/support.

To update (flash) the BIOS from a disc on the Windows 8 (64-bit) or Windows 8.1 (64-bit) operating system, do the following:

1. Start the Setup Utility program. See "Starting the Setup Utility program" on page 55.
2. From the Setup Utility program main menu, select **Exit → OS Optimized Default → Disabled**.
3. Select **Yes** in the window displayed and press Enter to confirm your selection.
4. Press F10 to save changes and exit the Setup Utility program. See "Exiting the Setup Utility program" on page 60.
5. Repeatedly press and release F12 when turning on the computer. When the Startup Device Menu window opens, release F12.
6. From the Startup Device Menu window, select the desired optical drive as the startup device. Then, insert the disc into this optical drive and press Enter. The update begins.
7. When prompted to change the serial number, it is suggested that you do not make this change by pressing N. However, if you do want to change the serial number, press Y, and then type in the serial number and press Enter.
8. When prompted to change the machine type and model, it is suggested that you do not make this change by pressing N. However, if you do want to change the machine type and model, press Y, and then type in the machine type and model and press Enter.
9. Follow the instructions on the screen to complete the update. After the update is completed, remove the disc from the optical drive.
10. Restart your computer and start the Setup Utility program. See "Starting the Setup Utility program" on page 55.
11. From the Setup Utility program main menu, select **Exit → OS Optimized Default → Enabled**.
12. Select **Yes** in the window displayed and press Enter to confirm your selection.
13. Press F10 to save changes and exit the Setup Utility program. See "Exiting the Setup Utility program" on page 60.

To update (flash) the BIOS from a disc on other operating systems, do the following:

1. Turn off your computer.
2. Repeatedly press and release F12 when turning on the computer. When the Startup Device Menu window opens, release F12.
3. From the Startup Device Menu window, select the desired optical drive as the startup device. Then, insert the disc into this optical drive and press Enter. The update begins.
4. When prompted to change the serial number, it is suggested that you do not make this change by pressing N. However, if you do want to change the serial number, press Y, and then type in the serial number and press Enter.
5. When prompted to change the machine type and model, it is suggested that you do not make this change by pressing N. However, if you do want to change the machine type and model, press Y, and then type in the machine type and model and press Enter.
6. Follow the instructions on the screen to complete the update. After the update is completed, remove the disc from the optical drive.

Updating (flashing) the BIOS from your operating system

Note: Because Lenovo makes constant improvements to its Web sites, the Web page contents are subject to change without notice, including the contents referenced in the following procedure.

To update (flash) the BIOS from your operating system, do the following:

1. Go to http://www.lenovo.com/support.
2. Click **Download Drivers & Software**.
3. Click **Use Quick Path**.
4. Type the 4-digit machine type for your computer in the **Quick Path** field and then click **Find My Product**.
5. Click **BIOS**.
6. Locate the BIOS version that you want to download.
7. Click **Click for files**. All available files will be displayed.
8. Click the link for the readme file that contains the instructions for updating (flashing) the BIOS from your operating system.
9. Print these instructions. This is very important because these instructions will not be displayed on the screen after the download begins.
10. Follow the printed instructions to download, extract, and install the update.

Recovering from a POST/BIOS update failure

If the power to your computer is interrupted while the POST and BIOS is being updated, your computer might not restart correctly. If this happens, perform the following procedure to recover from the POST and BIOS update failure. This procedure is commonly called Boot-block Recovery.

1. Remove all media from the drives and turn off all attached devices and the computer. Then, disconnect all power cords from electrical outlets and disconnect all cables that are connected to the computer.
2. Remove the computer cover. For computer models 30A0 and 30A1, refer to “Removing the computer cover” on page 86. For computer models 30A2 and 30A3, refer to “Removing the computer cover” on page 150.
3. Locate the Clear CMOS /Recovery jumper on the system board. See “Locating parts on the system board” on page 74.
4. Remove any cables that impede access to the Clear CMOS /Recovery jumper.
5. Move the jumper from the standard position (pin 1 and pin 2) to the maintenance position (pin 2 and pin 3).
6. Reconnect any cables that were disconnected and reinstall the PCI card if removed.
7. Close the computer cover and reconnect the power cords for the computer and monitor to electrical outlets. See “Completing the parts replacement” on page 147.
8. Turn on the computer and then insert the POST and BIOS update (flash update) disc into the optical drive. Wait a few minutes. Then, the recovery session begins. The recovery session will take two to three minutes. During this time, a warning message will be displayed and no action is needed from you.
9. After the recovery session is completed, there will be no video, and your computer will automatically turn off.
10. Repeat step 1 through step 5.
11. Move the Clear CMOS /Recovery jumper back to the standard position (pin 1 and pin 2).
12. Reconnect any cables that were disconnected and reinstall the PCI card if removed.
13. Close the computer cover and reconnect any cables that were disconnected.
14. Turn on the computer to restart the operating system.

Power management

Power management reduces the power consumption of certain components of the computer such as the system power supply, processor, hard disk drives, and some monitors.

Advanced configuration and power interface (ACPI) BIOS

Being an ACPI BIOS system, the operating system is allowed to control the power management features of the computer and the setting for Advanced Power Management (APM) BIOS mode is ignored. Not all operating systems support ACPI BIOS mode.

Automatic Power-on features

The Automatic Power-On features within the Power Management menu allow you to enable and disable features that turn on the computer automatically.

- **Wake Up on Alarm**: You can specify a date and time at which the computer will be turned on automatically. This can be either a single event or a daily event.
- **Wake on LAN**: If the computer has a properly configured token-ring or Ethernet LAN adapter card that is Wake on LAN-enabled and there is remote network management software, you can use the Wake on LAN feature. When you set Wake on LAN to **Enabled**, the computer will turn on when it receives a specific signal from another computer on the local area network (LAN).

To enable the Wake on LAN function or the Wake Up on Alarm function on the Windows 8 or Windows 8.1 operating system, do the following:

1. Open Control Panel.
2. Click **Hardware and Sound → Power Options**.
3. In the left panel, do one of the following:
    - For Windows 8: Click **Choose what the power buttons do**.
    - For Windows 8.1: Click **Choose what the power button does**.
4. In the **Shutdown setting** section, clear **Turn on fast startup**.

    Note: If the settings are unavailable, click **Change settings that are currently unavailable**.
5. Click **Save changes**.

Appendix A. System memory speed

The Intel Xeon® microprocessor families compatible with this ThinkStation computer feature an integrated memory controller, which provides the microprocessor with direct access to the system memory. Because of this design, the system memory speed will be determined by a number of factors, including the microprocessor model and the type, speed, size (capacity), and number of DIMMs installed. Refer to the following table for the information on the supported system memory speed for your own computer model.

Table 3. DIMM type and speed: PC3-12800

DIMM operating voltage	Microprocessor model	Memory frequency
1.5 V	Intel Xeon E3-1280V3, Intel Xeon E3-1270V3, Intel Xeon E3-1240V3, Intel Xeon E3-1230V3, Intel Xeon E3-1220V3, Intel Xeon E3-1275V3, Intel Xeon E3-1245V3, Intel Xeon E3-1225V3, Intel i7-4770, Intel i5-4670, Intel i5-4570	1600 MHz

Table 4. DIMM type and speed: PC3-12800E

DIMM operating voltage	Microprocessor model	Memory frequency
1.5 V	Intel Xeon E3-1280V3, Intel Xeon E3-1270V3, Intel Xeon E3-1240V3, Intel Xeon E3-1230V3, Intel Xeon E3-1220V3, Intel Xeon E3-1275V3, Intel Xeon E3-1245V3, Intel Xeon E3-1225V3, Intel i7-4770, Intel i5-4670, Intel i5-4570	1600 MHz

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